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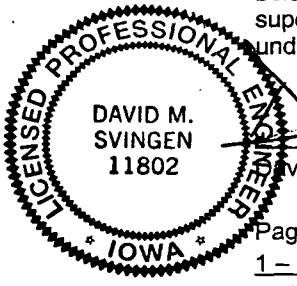
# ANNUAL MONITORING REPORT 2003
# GROUNDWATER QUALITY AND MONITORING WELL PERFORMANCE

## PLYMOUTH COUNTY SANITARY LANDFILL
## PLYMOUTH COUNTY, IOWA
## FACILITY NO. 75-SDP-1-74P

**Terracon Project No. 40905033**
**November 28, 2003**

I hereby certify the portion of this engineering document described below was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.




David M. Svingen Certificate No. 11802

Pages or sheets covered by this seal: Report pages 1 – 17; Appendix A – Figures 1 – 6; Appendix B; and Appendix C; Tables 1, 2, and 3

Date Issued: _____

License Renewal Date: 12/31/03

***Prepared for:***

**PLYMOUTH COUNTY SOLID WASTE AGENCY**
**Plymouth County, Iowa**

***Prepared by:***

**TERRACON**
**Omaha, Nebraska**

Terracon

Form 101—1-87

November 28, 2003

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Plymouth County Solid Waste Agency
c/o Mr. Roger Dibble
P.O. Box 904
LeMars, IA 51031-0904

Re: Annual Monitoring Report 2003
Groundwater Quality and Monitoring Well Performance
Plymouth County Landfill
Permit No. 75-SDP-1-74P
Terracon Project No. 40905033

Dear Mr. Dibble:

Enclosed is a report for the annual monitoring of water quality and monitoring well performance for the Plymouth County Landfill. This report serves to meet Iowa Department of Natural Resources (IDNR) annual monitoring reporting requirements set forth in IDNR's Regulations for Solid Waste Disposal, Chapter 103. This report does not, however, contain site inspection/special waste authorization information. We understand that site inspection/special waste authorization information is to be reported by Mr. Scott Langel, P.E., the registered design engineer as specified in the landfill's permit (No. 75-SDP-1-74P).

Thank you for the opportunity to be of continued service to you on this project. If there are any questions concerning this report, please contact us.

Sincerely,
**TERRACON**

Rod Baumann, P.G.
Project Geologist

David M. Svingen, P.E., P.G.
Principal

RMB/DMS:rmb/leb

Enclosure

Copies to: Addressee (1)
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**Plymouth County Landfill**
**Permit No. 75-SDP-1-74P**

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## 1.0 INTRODUCTION

The subject site is an existing landfill operating under Iowa Department of Natural Resources (IDNR) permit number 75-SDP-1-74P, in Plymouth County of northwestern Iowa. The Plymouth County Landfill is located within the NE $^1/_4$ of Section 34, in Township 93 North, Range 45 West, in Plymouth County, Iowa and its location is depicted in Figures 1 and 2 (Appendix A).

Landfill personnel have performed water quality sampling and analysis for the 2003 calendar year at the Plymouth County Landfill. Monitoring consisted of sampling and analyzing groundwater from 11 water table monitoring wells (three up-gradient wells and eight down-gradient wells). The wells are depicted in Figure 3 (Appendix A).

Past sampling and analysis have shown well MW-17 to be most appropriate for use as an up-gradient well for making statistical comparisons to the remaining wells at the landfill. To date, there has been no evidence of impact to groundwater at MW-17 from the landfill.

Most of the wells at the landfill have been subjected to monitoring for routine annual and semi-annual parameters. Many wells have also been used to monitor for volatile organic compounds (VOCs) in response to a Groundwater Quality Assessment Plan (GWQAP) for assessing the extent of VOCs detected at several wells during previous monitoring. A summary of whether routine annual and semi-annual parameters and/or specified VOC parameters are required for testing at respective wells is provided below.

| Well No. | Routine Semi-Annual and Annual Sampling | GWQAP Semi-Annual Sampling for Specified VOCs |
|---|---|---|
| MW-7 | Required | Required |
| MW-8 | Required | Required |
| MW-9 | Required | Required |
| MW-10 | Required | Not Required |
| MW-11 | Required | Not Required |
| MW-12 | Required | Required |
| MW-13 | Required | Not Required |
| MW-14 | Required | Required |
| MW-15 | Not Required | Required |
| MW-16 | Not Required | Required |
| MW-17 | Required | Required |

Note: Wells MW-1 through MW-6 have been abandoned.

Laboratory reports, chain-of-custody documentation, and field data forms have been previously submitted to the IDNR by landfill personnel for each semi-annual monitoring event. Copies of these documents are retained at the Plymouth County Landfill. During 2003, groundwater sampling was performed on April 3 and October 7.

## 2.0 STATISTICAL CONSIDERATIONS

Monitoring well MW-17 was considered as the up-gradient location in the water quality monitoring program. Statistical evaluation of temperature has not been included since temperature data, to a large degree, is dependent upon ambient conditions. Ambient conditions may cause temperature readings to deviate from actual groundwater conditions as a result of the method used to measure groundwater temperatures. Nevertheless, temperatures recorded during the sampling events do not indicate obvious indications of temperature fluctuations that may be the result of endothermic or exothermic chemical reactions.

Control bounds were computed in general accordance with guidelines set forth in IAC 103.2(6). One-half of the laboratory method detection limit (MDL) was used in statistical computations in instances where chemicals were reported at concentrations below the MDL.

Laboratory analytical summary sheets for each sampling location have been provided in Appendix B. Graphs with control limits showing concentrations versus time for sampling locations are also included in Appendix B. The parameters given statistical consideration include routine semi-annual and annual parameters and select VOC parameters at selected wells as listed below.

| Semi-annual Parameters | Annual Parameters | Select VOCs at GWQAP Wells |
|---|---|---|
| Chloride | Phenols (Total) | Benzene |
| Chemical Oxygen Demand | Total Organic Halogens | 1,2-Dichloroethane |
| Iron (dissolved) | | 1,1-Dichloroethene |
| Ammonia Nitrogen | | Trichloroethene |
| pH | | |
| Specific Conductance | | |

It should be noted that GWQAP wells that only require sampling for VOCs have been occasionally sampled for semi-annual and annual parameters, which was not necessary. Conversely, wells that only require sampling for semi-annual and annual parameters have been occasionally sampled for VOCs, which was not necessary. The additional data was included in the Appendix B tables, but may or may not be included in the Appendix B graphs.

## 3.0 GROUNDWATER IMPACT DISCUSSIONS

Discussion in this section is provided for chemical parameters that fall outside of the upper and lower control limits on a well-by-well basis. Chemical parameters which fall within established control limits are not discussed. Well discussions are presented in reverse order of the well number system (i.e. well MW-17 is discussed first and well MW-7 is discussed last) since well MW-17 is the up-gradient well used for statistical comparison to other wells.

Upper and lower control limits for each of the monitoring wells (MW-7 through MW-17) were based on data obtained for up-gradient well MW-17 as required by IAC Chapter 103.2(b). In some cases, upper and lower control limits are equivalent due to non-detection of certain parameters since monitoring began. In this case, analyte concentrations plot on a single control bound line (no deviation from the mean of the data) instead of between upper and lower control bounds.

### 3.1 MW-17 (Up-Gradient Well)

Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-17 are as follows:

- **Chloride:** Only one data point (July 1, 1998) plotted above the upper control limit for chloride. Compared to the other data points on the graph, this data point appears to be anomalous and not consistent with other monitoring data.

- **Chemical Oxygen Demand:** One data point (October 6, 2002) plotted above the upper control limit for chemical oxygen demand. Compared to the other data points

on the graph, this data point and the data point of April 3, 2003 appear to be anomalous and not consistent with other monitoring data.

- **pH:** Only one data point (October 17, 2000) plotted below the lower control limit for pH. Compared to the other data points on the graph, this data point appears to be anomalous and not consistent with other monitoring data.

- **Specific Conductance:** Only one data point (April 3, 2003) plotted marginally below the lower control limit for specific conductance. Compared to the other data points on the graph, the marginal exceedance below the lower control limit is not considered to be significant.

### 3.2 MW-16 (Up-Gradient Well)

Well MW-16 is a GWQAP well installed for monitoring certain VOC compounds. VOC analytes were not detected and, consequently, did not exhibit concentrations which plotted outside of the control limits established from up-gradient well MW-17.

### 3.3 MW-15 (Down-Gradient Well)

Well MW-15 is a GWQAP well installed for monitoring certain VOC compounds. Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-17 are as follows:

- **Trichloroethene (TCE):** Data has consistently plotted above the upper control limit for TCE since September of 1999. It appears that TCE is present in groundwater at well MW-15. However, the detected TCE concentrations are below the maximum contaminant level (MCL) drinking water standard of 5 ug/l.

- **Total Organic Halogens (TOH):** The two test results for this analyte indicates impact to groundwater which is consistent with the detection of TCE discussed above. Note that TOH is a routine annual parameter not required to be tested in groundwater collected from MW-15.

- **Specific Conductance:** With the exception of what appears to be erroneous data for October 24, 2001 and April 28, 2002, data for this analyte plotted consistently above the upper control bound established by up-gradient well MW-17. Based on indications of groundwater impact by TCE, as stated above, the elevated chloride concentrations may be indicative of impact from the landfill.

### 3.4 MW-14 (Down-Gradient Well)

Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-17 are as follows:

- **Chloride:** Each of the data points plotted above the upper control limit for chloride. Based on other indications of groundwater impact at well MW-14 (i.e. VOCs), the elevated chloride concentrations may be indicative of impact from the landfill.

- **Chemical Oxygen Demand:** The July 12, 1996 data point plotted above the upper control limit for chemical oxygen demand. Compared to the other data points on the graph, this data point appears to be anomalous and not consistent with other monitoring data. More recent data, within the last year, reveals two data points plotting above the upper control limit. The recent chemical oxygen demand detections may be indicative of relatively recent groundwater impact resulting in the increased chemical oxygen demand concentrations. Future monitoring should provide an indication whether this current trend continues.

- **Dissolved Iron:** The March 25, 2001 data point plotted above the upper control limit for chemical oxygen demand. Compared to the other data points on the graph, this data point appears to be anomalous and not consistent with other monitoring data.

- **Benzene:** Benzene was not detected at MW-14. Two early data points plot above the upper control bound limit because the laboratory detection levels were elevated for these sample dates.

- **1,2-Dichloroethane (DCA):** Six data points plot above the upper control limit for DCA. One of the exceedances is due to elevated laboratory detection limits. However, five exceedances were due to detections of DCA marginally above detection limits which are above the negligible risk level (NRL) of 0.4 ug/l but below the maximum contaminant level (MCL) of 5 ug/l.

- **1,1-Dichloroethene (DCE):** DCE was not detected at MW-14. Two early data points plot below the lower control bound limit because the laboratory detection levels were lower for these sample dates relative to subsequent data analyses.

- **1,1,1-Trichloroethane (TCA):** Two data points plot above the upper control limit for TCA. However, TCA concentrations do not exceed the MCL groundwater action level of 200 ug/l. TCA is not a required VOC parameter for GWQAP monitoring.

TCA data for MW-14 is historic data obtained through early quarterly background monitoring.

- **Trichloroethene (TCE):** Most of the data points plot above the upper control limit for TCE. However, none of the data points exhibited a concentration exceeding the MCL groundwater action level of 5 ug/l.

- **Total Organic Halogens (TOH):** Most of the data points plot above the upper control limit for TOH. These results are consistent with VOC detections as stated above.

- **Specific Conductance:** Each of the data points plotted above the upper control limit for specific conductance. Based on other indications of groundwater impact at well MW-14 (i.e. VOCs), the elevated specific conductance concentrations may be indicative of impact from the landfill.

### 3.5 MW-13 (Down-Gradient Well)

Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-17 are as follows:

- **Chloride:** Each of the data points plotted above the upper control limit for chloride. Based on other indications of groundwater impact at well MW-13 (i.e. arsenic from quarterly background monitoring not covered in this report), the elevated chloride concentrations may be indicative of impact from the landfill.

- **Chemical Oxygen Demand:** Three data points plot above the upper control limit for chemical oxygen demand. Compared to the other data points on the graph, these data points do not appear to be a significant indicator of impact to groundwater.

- **Ammonia Nitrogen:** The April 12, 2000 data point plotted above the upper control limit for ammonia nitrogen. Compared to the other data points on the graph, this data point appears to be anomalous and not consistent with other monitoring data.

- **Iron:** Several of the data points plotted above the upper control limit for iron. Based on other indications of groundwater impact at well MW-13 (i.e. arsenic from quarterly background monitoring not covered in this report and chloride), the elevated iron concentrations may be indicative of impact from the landfill.

- **Benzene:** Benzene was not detected at MW-13. Two early data points plot above the upper control bound limit because the laboratory detection levels were elevated for these sample dates.

- **1,2-Dichloroethane (DCA):** DCA was not detected at MW-13. One data point plotted above the upper control limit for DCA. The exceedance is due to elevated laboratory detection limits.

- **1,1-Dichloroethene (DCE):** DCE was not detected at MW-13. Two early data points plot below the lower control bound limit because the laboratory detection levels were lower for these sample dates relative to subsequent data analyses.

- **Total Organic Halogens (TOH):** TOH was detected for two of the past seven monitoring events when TOH was analyzed. Compared to the other data points on the graph, the two detections may be anomalous at the current time and not consistent with other monitoring data.

- **Specific Conductance:** Several of the data points plotted above the upper control limit for specific conductance. Based on other indications of groundwater impact at well MW-13 (i.e. arsenic from quarterly background monitoring not covered in this report, iron, and chloride), the elevated specific conductance concentrations may be indicative of impact from the landfill. However, the suspect specific conductance concentrations do not grossly exceed the upper control limit.

### 3.6 MW-12 (Down-Gradient Well)

Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-17 are as follows:

- **Chloride:** Nearly all of the data points have plotted above the upper control limit for chloride. Based on other indications of groundwater impact at well MW-12 (i.e. VOCs and total organic halogens), the elevated chloride concentrations appear to be indicative of impact from the landfill.

- **Chemical Oxygen Demand:** Four data points plotted above the upper control limit for specific conductance. Compared to the other data points on the graph, these data points appear to be anomalous and not consistent with other monitoring data.

- **Ammonia Nitrogen:** The October 19, 1998 data point plotted above the upper control limit. Compared to the other data points on the graph, this data point appears to be anomalous and not consistent with other monitoring data.

- **Benzene:** Each of the data points plot above the upper control limit for benzene. One of the data points exceeded the control limit because of an elevated laboratory detection limit. The other exceedances were due to detections of benzene at concentrations which are above the negligible risk level (NRL) groundwater action level of 1.0 ug/l but below the maximum contaminant level (MCL) of 5 ug/l.

- **1,1-Dichloroethene (DCE):** DCE was not detected at MW-12. One early data point plots below the lower control bound limit because the laboratory detection levels were lower for this sample date relative to subsequent data analyses.

- **1,1,1-Trichloroethane (TCA):** Three data points plot above the upper control limit for TCA. However, TCA concentrations do not exceed the maximum contaminant level (MCL) groundwater action level of 200 ug/l. TCA is not a required VOC parameter for GWQAP monitoring. TCA data for MW-12 is historic data obtained through early quarterly background monitoring.

- **Trichloroethene (TCE):** Each data point plots above the upper control limit for TCE. Many of these data points exhibited a concentration exceeding the negligible risk level (NRL) of 3 ug/l and the maximum contaminant level (MCL) of 5 ug/l, but only marginally.

- **Total Organic Halogens (TOH):** Each of the data points plot above the upper control limit for TOH. These results are consistent with VOC detections as stated above.

- **pH:** One data point exhibited a pH value of 5.0 and plotted below the lower control limit for pH. The 5.0 pH value appears to be anomalously low and not consistent with other measured pH values. Other measured pH values are between control limits.

- **Specific Conductance:** Each of the data points plotted above the upper control limit for specific conductance. Based on other indications of groundwater impact at well MW-12 (i.e. VOCs and total organic halogens), the elevated specific conductance concentrations appear to be indicative of impact from the landfill.

### 3.7 MW-11 (Down-Gradient Well)

Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-17 are as follows:

- **Chloride:** All of the data points plotted above the upper control limit for chloride The elevated chloride concentrations may be indicative of impact from the landfill.

- **Chemical Oxygen Demand:** One data point plots above the upper control limit for specific conductance. Compared to the other data points on the graph, this data point appears to be anomalous and not consistent with other monitoring data.

- **Iron:** The July 12, 1996 data point plotted above the upper control limit. Compared to the other data points on the graph, the suspect data point appears to be anomalous and not consistent with other monitoring data. Continued monitoring subsequent to the July 12, 1996 date indicates that iron concentrations at MW-11 have not been detected.

- **Benzene:** Benzene was not detected at MW-11. Two early data points plotted above the upper control bound limit because the laboratory detection levels were elevated for these sample dates.

- **1,2-Dichloroethane (DCA):** DCA was not detected at MW-11. One early data point plotted above the upper control bound limit because the laboratory detection level was elevated for that sample date.

- **1,1-Dichloroethene (DCE):** DCE was not detected at MW-11. Two early data points plotted below the lower control bound limit because the laboratory detection levels were lower for these sample dates relative to subsequent data analyses.

- **1,1,1-Trichloroethane (TCA):** One data point plotted above the upper control limit for TCA. However, the elevated TCA concentration does not exceed the maximum contaminant level (MCL) of 200 ug/l. TCA is not a required VOC parameter for GWQAP monitoring. TCA data for MW-11 is historic data obtained through early quarterly background monitoring.

- **Total Organic Halogens (TOH):** Two early data points plot above the upper control limit for TOH. Continued monitoring subsequent to these dates indicates that TOH concentrations at MW-11 have not been detected.

- **Specific Conductance:** Most of the data points plotted above the upper control limit for specific conductance. The elevated specific conductance concentrations may be indicative of impact from the landfill.

### 3.8 MW-10 (Down-Gradient Well)

Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-17 are as follows:

- **Chloride:** Each of the data points plotted above the upper control limit for chloride. Based on total organic halogen detections as discussed below, the elevated chloride concentrations appear to be indicative of impact from the landfill.

- **Chemical Oxygen Demand:** Values which plot above the upper control limit for chemical oxygen demand appear to be anomalous.

- **Ammonia Nitrogen:** The August 9, 1996 data point plotted above the upper control limit. Compared to the other data points on the graph, this data point appears to be anomalous and not consistent with other monitoring data. Continued monitoring subsequent to August 9, 1996 indicates that ammonia nitrogen concentrations at MW-10 have not been detected.

- **Iron:** The April 17, 1997 data point plotted above the upper control limit. Other data points on the graph did not exhibit detectable iron concentrations. The one time detection of iron in well MW-10 appears to be anomalous.

- **Benzene:** Benzene was not detected at MW-10. Two early data points plotted above the upper control bound limit because the laboratory detection levels were elevated for these sample dates.

- **1,2-Dichloroethane (DCA):** DCA was not detected at MW-10. One early data point plotted above the upper control limit because the laboratory detection level was elevated for that sample date.

- **1,1-Dichloroethene (DCE):** DCE was not detected at MW-10. Two early data points plotted below the lower control bound limit because the laboratory detection levels were lower for these sample dates relative to subsequent data analyses.

- **Trichloroethene (TCE):** One data point plotted above the upper control limit for TCE. However, the elevated TCA concentration does not exceed the negligible risk level (NRL) of 3 ug/l or the maximum contaminant level (MCL) of 5 ug/l.

- **Phenols:** The earliest data point plotted above the upper control bound established by up-gradient well MW-17 for total phenols. This detected phenol concentration appear to be anomalous.

- **Total Organic Halogens (TOH):** Most of the data points plot above the upper control limit for TOH. These results appear to be indicative of landfill impact to groundwater.

- **Specific Conductance:** Most of the data points plotted above the upper control limit for specific conductance. The elevated specific conductance concentrations appear to be indicative of impact from the landfill.

### 3.9 MW-9 (Down-Gradient Well)

Well MW-9 has not produced a sufficient amount of water for sampling since 1999. The discussion below is based on data generated through monitoring which occurred between 1996 and 1999. Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-17 are as follows:

- **Chloride:** Each of the data points plotted above the upper control limit for chloride. Based on detections of VOCs and total organic halogens, as stated below, the elevated chloride concentrations appear to be indicative of impact from the landfill.

- **Benzene:** Benzene was not detected at MW-9. One early data point plotted above the upper control bound limit because the laboratory detection levels were elevated for that sample date.

- **1,2-Dichloroethane (DCA):** Four data points plot above the upper control limit for DCA. The exceedances were due to detections of DCA either at or marginally above the negligible risk level (NRL) of 0.4 ug/l. The exceedances are, however, below the maximum contaminant level (MCL) of 5 ug/l.

- **1,1-Dichloroethene (DCE):** DCE was not detected at MW-9. One early data point plotted below the lower control bound limit because the laboratory detection level was lower for this sample date relative to subsequent data analyses.

- **Phenols:** The earliest of three phenol data points plotted above the upper control limit for phenol. Further monitoring is necessary to evaluate whether this detection is anomalous or if future detections indicate phenol impact to groundwater at well MW-9.

- **Total Organic Halogen (TOH):** Two of three data points plot above the upper control limit for TOH. These results are consistent with DCA detections as stated above.

- **Specific Conductance:** Each of the data points plotted above the upper control limit for specific conductance. Based on other indications of groundwater impact at well MW-9 (i.e. select VOCs and total organic halogens), the elevated specific conductance concentrations appear to be indicative of impact from the landfill.

### 3.10 MW-8 (Down-Gradient Well)

Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-17 are as follows:

- **Chloride:** All of the data points plotted above the upper control limit for chloride Based on detections of VOCs and TOH at this well, as discussed below, the elevated chloride concentrations appear to be indicative of impact from the landfill.

- **Chemical Oxygen Demand:** One data point plotted marginally above the upper control limit. This data point and several other COD detections in well MW-8 are not considered to be significant at this time.

- **Iron:** Four data points plotted marginally above the upper control limit. Other data points on the graph did not exhibit detectable iron concentrations. It is difficult to state whether the iron data indicates impact to groundwater from the landfill.

- **Benzene:** Most of the data points plot above the upper control limit for benzene. The exceedances were due to detections of benzene which are above the negligible risk level (NRL) of 1.0 ug/l but below the maximum contaminant level (MCL) of 5 ug/l.

- **1,2-Dichloroethane (DCA):** Most of the data points plot above the upper control limit for DCA. The exceedances were due to detections of DCA which are above the negligible risk level (NRL) of 0.4 ug/l but below the maximum contaminant level (MCL) of 5 ug/l.

- **1,1-Dichloroethene (DCE):** The October 11, 1996 data point plotted above the upper control bound limit. Compared to the other data points on the graph, this data point appears to be anomalous and not consistent with other monitoring data. Continued monitoring subsequent to the October 11, 1996 sampling date indicates that DCE concentrations at MW-8 have not been detected.

- **Trichloroethene (TCE):** All data points plotted above the upper control limit for TCE. The exceedances were due to detections of TCE which are above the negligible risk level (NRL) of 3.0 ug/l and above the maximum contaminant level (MCL) of 5.0 ug/l but appear to be exhibiting a decreasing trend.

- **Phenols:** The earliest phenol data point plotted above the upper control limit for phenol. It appears that the detected phenol concentration may be anomalous.

- **Total Organic Halogen (TOH):** Each of the data points plot above the upper control limit for TOH. These results are consistent with DCA and TCE detections as stated above.

- **Specific Conductance:** Most of the data points plotted above the upper control limit for specific conductance. Based on other indications of groundwater impact at well MW-8 (i.e. VOCs and total organic halogens), the elevated specific conductance concentrations may be indicative of impact from the landfill.

### 3.11 MW-7 (Up-Gradient Well)

Analytes whose concentrations fall outside of the control limits established from up-gradient well MW-17 are as follows:

- **Chloride:** Several chloride data points plot marginally above the upper control limit for chloride. This marginal exceedence may be indicative of impact from the landfill.

- **Chemical Oxygen Demand:** The July 12, 1996 data point plotted above the upper control limit. The elevated chemical oxygen demand value appears to be anomalous and not consistent with other monitoring data. More recent data indicates chemical oxygen demand detections that are plotted marginally above the upper control limit, which are not considered significant at this time.

- **Ammonia Nitrogen:** The most recent data point plotted above the upper control bound but is not consistent with other data which indicates ammonia has not been detected. The recent data point appears to be anomalous.

- **Iron:** Three data points plotted marginally above the upper control limit for iron. Other data points on the graph did not exhibit detectable iron concentrations. It is not clear whether the iron data indicates impact to groundwater from the landfill.

- **Benzene:** Two early data points plotted above the upper control limit for benzene because the laboratory detection levels were elevated for these sample dates. Several later data points also plotted above the upper control limit due to detections of benzene which are at or below the negligible risk level of 1.0 ug/l and below the maximum contaminant level of 5.0 ug/l.

- **1,2-Dichloroethane (DCA):** Two early data points plotted above the upper control limit. The elevated DCA values appear to be anomalous and not consistent with other monitoring data. Continued monitoring subsequent to the elevated data points indicates that DCA concentrations at MW-7 have not been detected.

- **1,1-Dichloroethene (DCE):** DCE was not detected at MW-7. However, two early data points plotted below the lower control bound limit because the laboratory detection level was lower for these sample dates relative to subsequent data analyses.

- **Trichloroethene (TCE):** Each data point plotted above the upper control limit for TCE. The exceedances were due to detections of TCE which are above the negligible risk level of 3.0 ug/l and above the maximum contaminant level (MCL) of 5.0 ug/l.

- **Total Organic Halogen (TOH):** Each of the data points plotted above the upper control limit for TOH. These results are consistent with TCE detections as stated above.

- **pH:** A single data point plots below the lower control limit, but is not a significant deviation from the control bounds.

- **Specific Conductance:** Each of the data points plotted above the upper control limit for specific conductance. Based on other indications of groundwater impact at well MW-7 (i.e. VOCs and total organic halogens), the elevated specific conductance concentrations appear to be indicative of impact from the landfill.

## 4.0 MONITORING WELL PERFORMANCE

The current site monitoring instruments were evaluated in general accordance with the approved Hydrologic Monitoring System Plan, dated October 23, 1998. The purpose of this evaluation was to assess whether the integrity of groundwater monitoring instruments is sufficient to adequately monitor groundwater at the landfill as described in the approved HMSP.

### 4.1 Well Location Evaluation [110.9(2)a]

For the 2003 calendar year, groundwater elevation measurement events for 11 water table monitoring wells (see Figure 3, Appendix A) were conducted monthly by landfill personnel. The results of these events have been tabulated in Table 1 (Appendix C).

Water levels of individual wells have exhibited seasonal fluctuations over the past year. Ideally, water levels should be within the screened interval for water table monitoring wells, particularly to monitor for the presence of light non-aqueous phase liquids (LNAPLs) which collect at the water table surface. As can be seen from Table 1 (Appendix C), water levels were measured to be within the screened interval at each well throughout the calendar year 2003. The only exception was for water levels measured at well MW-9 where this well was observed to be dry, indicating that the water table dropped below the well screen interval. Except for well MW-9, the water table monitoring wells will continue to suffice as viable groundwater monitoring points. Well MW-9 has not been a viable monitoring instrument for the past three years and will continue to provide limited monitoring value unless seasonal water table levels rise above the base of the screened interval at well MW-9. If well MW-9 continues to be dry for an extended period of time, replacement with a deeper well may be necessary.

The general direction of groundwater flow was evaluated for each month's data. The general groundwater flow direction has not changed since groundwater flow was assessed in 1991 for the hydrogeologic assessment. To demonstrate this finding, water level data from three arbitrarily selected monitoring dates was used to construct water table contour maps (Figures 4, 5, and 6, Appendix A). The inferred groundwater flow direction shown on these maps is similar to the inferred groundwater flow direction depicted on maps presented in the hydrogeologic assessment report and previous annual groundwater monitoring reports.

Based on the above findings, the monitoring wells' positioning, with respect to well depth (vertical) and also with respect to location along the buried waste perimeter (lateral), continues to be adequate. Up-gradient and down-gradient well designations as described in the HMSP should continue to be used.

### 4.2 Effects of Landfill Operations on Hydrogeologic Setting [110.9(2)b]

Methods for landfilling of solid waste throughout 2003 have not varied significantly from original landfilling methods employed when landfilling commenced in 1975. Based on groundwater information discussed above in Section 4.1, it does not appear that landfill operations are altering the hydrogeologic setting at the landfill site.

### 4.3 Well Sedimentation [110.9(2)c]

According to the approved HMSP, well depths need to be measured annually to evaluate if the wells are physically intact and not filling with sediment. Well depths were measured during semi-annual monitoring events and recorded on IDNR form 542-1322 which accompanied semi-annual analytical reports submitted to the IDNR and retained at the landfill. The results of these measurements, when compared with well depths depicted on boring logs included in the hydrogeologic assessment report (dated April 26, 1991) and the HMSP (dated October 23, 1998), show that significant silting of site monitoring instruments has not occurred.

### 4.4 Periodic In-Situ Permeability Tests [110.9(2)d]

According to the approved HMSP, hydraulic conductivities are to be evaluated at monitoring instruments once every five years. Hydraulic conductivity evaluation of the monitoring instruments was performed during 1991 and 1998. Summaries of hydraulic conductivity testing are documented in the 1991 and 1998 annual reports. Hydraulic conductivity measurements were conducted again in 2003. Results of the 2003 hydraulic conductivity testing are summarized in Table 3 (Appendix C) along with results obtained from prior years testing. Hydraulic conductivity data and analysis sheets are contained in Appendix D.

The test data indicate relative consistency (less than one order of magnitude difference) of hydraulic conductivity values between the test dates for individual wells, with the exception of well MW-10. Well MW-2 shows variation of about 1.5 orders of magnitude for the two testing events conducted in 1991 and 1998. Testing could not be conducted at MW-10 during 2003 because of insufficient water in the well. Current conductivity data indicates fouling of well screens by silt or bacteria is not considered to be a problem at this time. The wells continue to be viable for continued groundwater monitoring.

## 5.0 LEACHATE WELL MONITORING

Leachate levels were measured monthly by landfill personnel during 2003. Results of leachate measurements made at leachate wells (LW-1, LW-2, LW-3, and LW-4) are summarized in Table 2 (Appendix C). Leachate was detected in each of the four leachate wells throughout the

year. Leachate thicknesses remained less than one foot at the bottom of each of the leachate wells. Locations of leachate wells are depicted in Figure 3 (Appendix A).

## 6.0 GENERAL COMMENTS

The analysis and opinions expressed in this report are based upon data obtained from the monitoring wells installed at the indicated locations and from any other information discussed in this report. This report does not reflect any variations in subsurface chemistry, stratigraphy, or geohydrology which may occur between borings or across the site. Actual subsurface conditions may vary and may not become evident without further exploration.

This report is prepared for the exclusive use of the Plymouth County Solid Waste Agency for specific application to the project discussed and has been prepared in accordance with generally accepted environmental engineering practices. No warranties, either express or implied, are intended or made. In the event any changes in the nature or location of observed conditions as outlined in this report are found, this report cannot be considered valid unless these changes are reviewed and the opinions of this report are modified or verified in writing by Terracon.

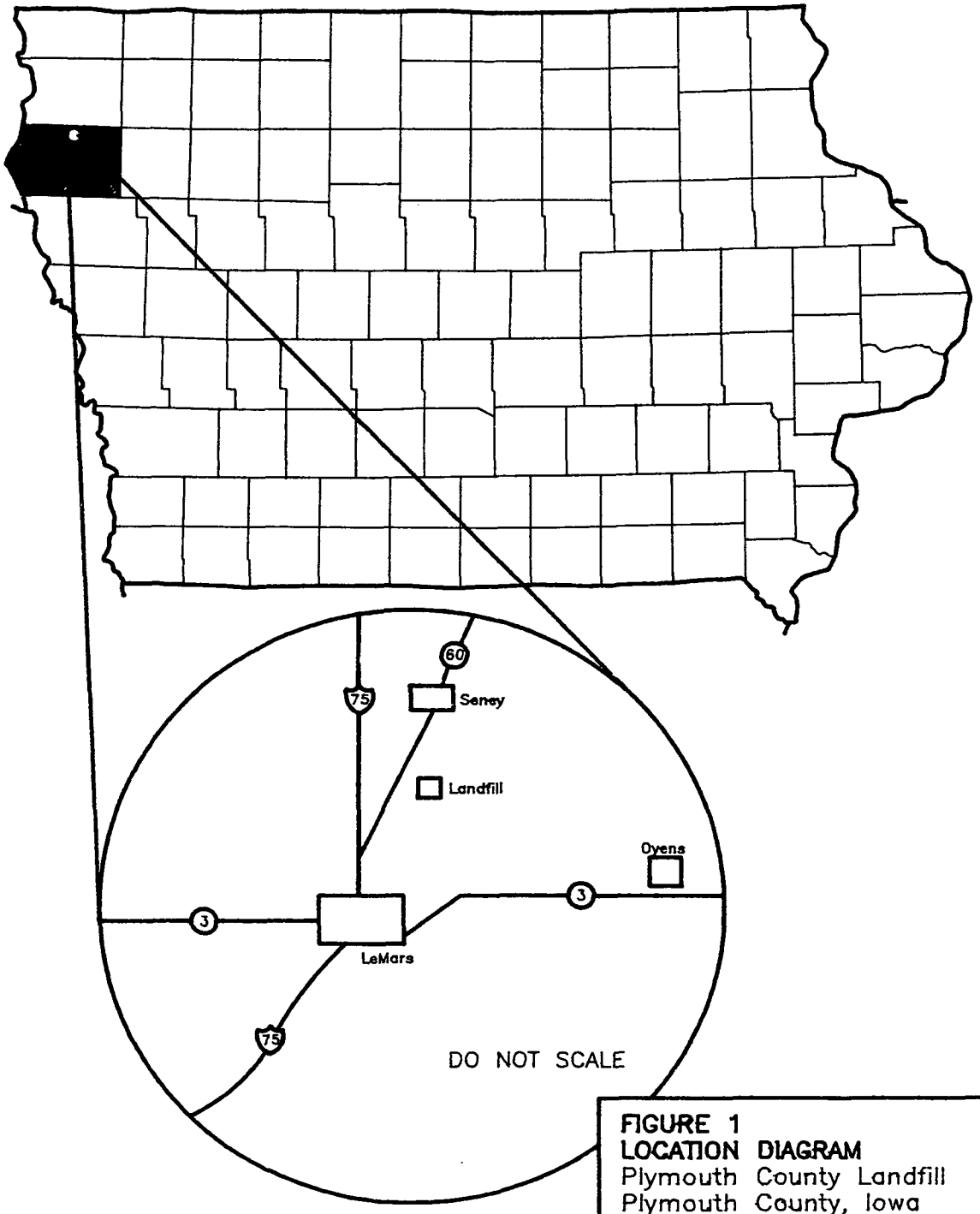
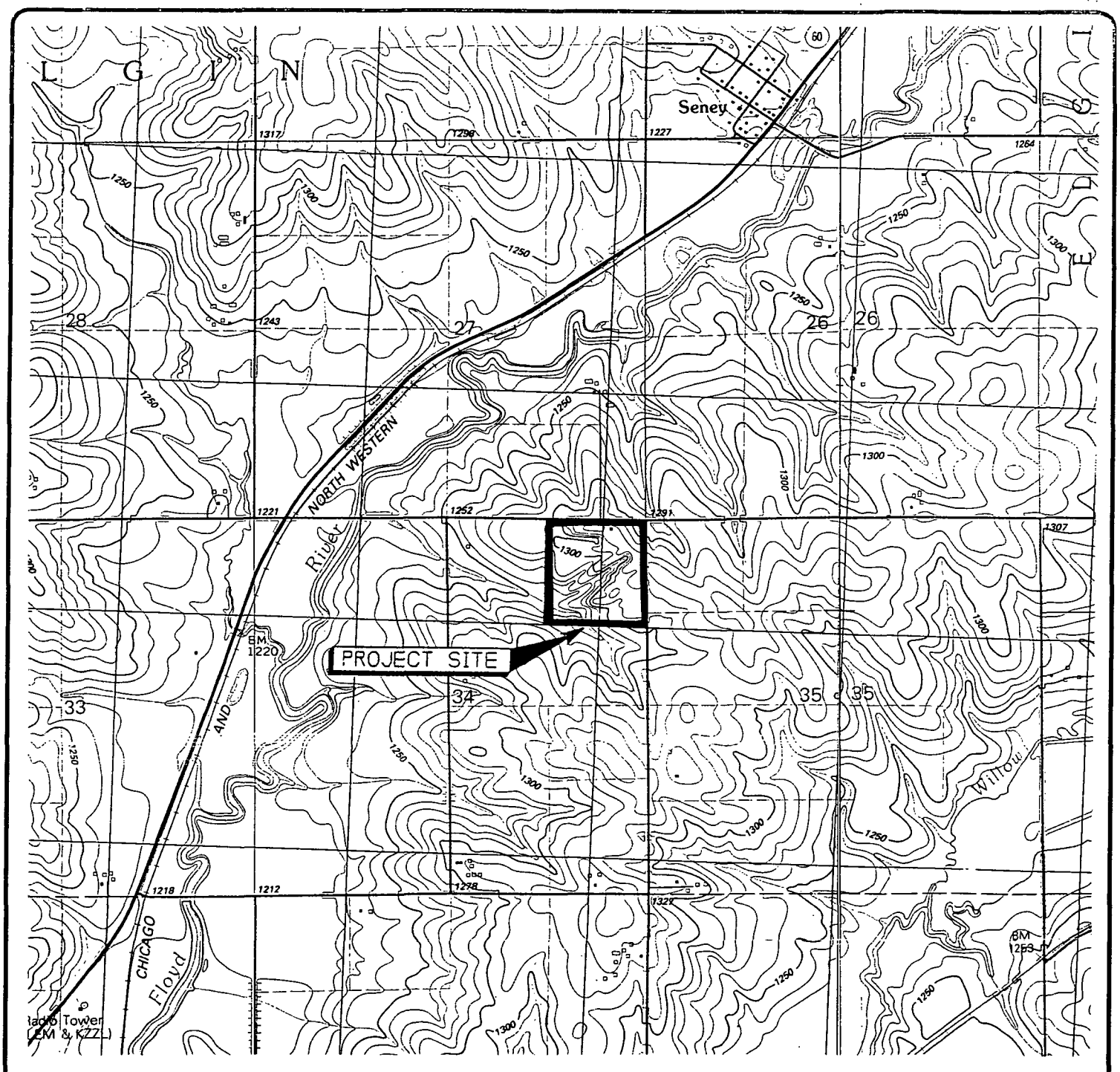



**FIGURE 1**
**LOCATION DIAGRAM**
Plymouth County Landfill
Plymouth County, Iowa
Job No. 40905033

Terracon




0 1 MILE

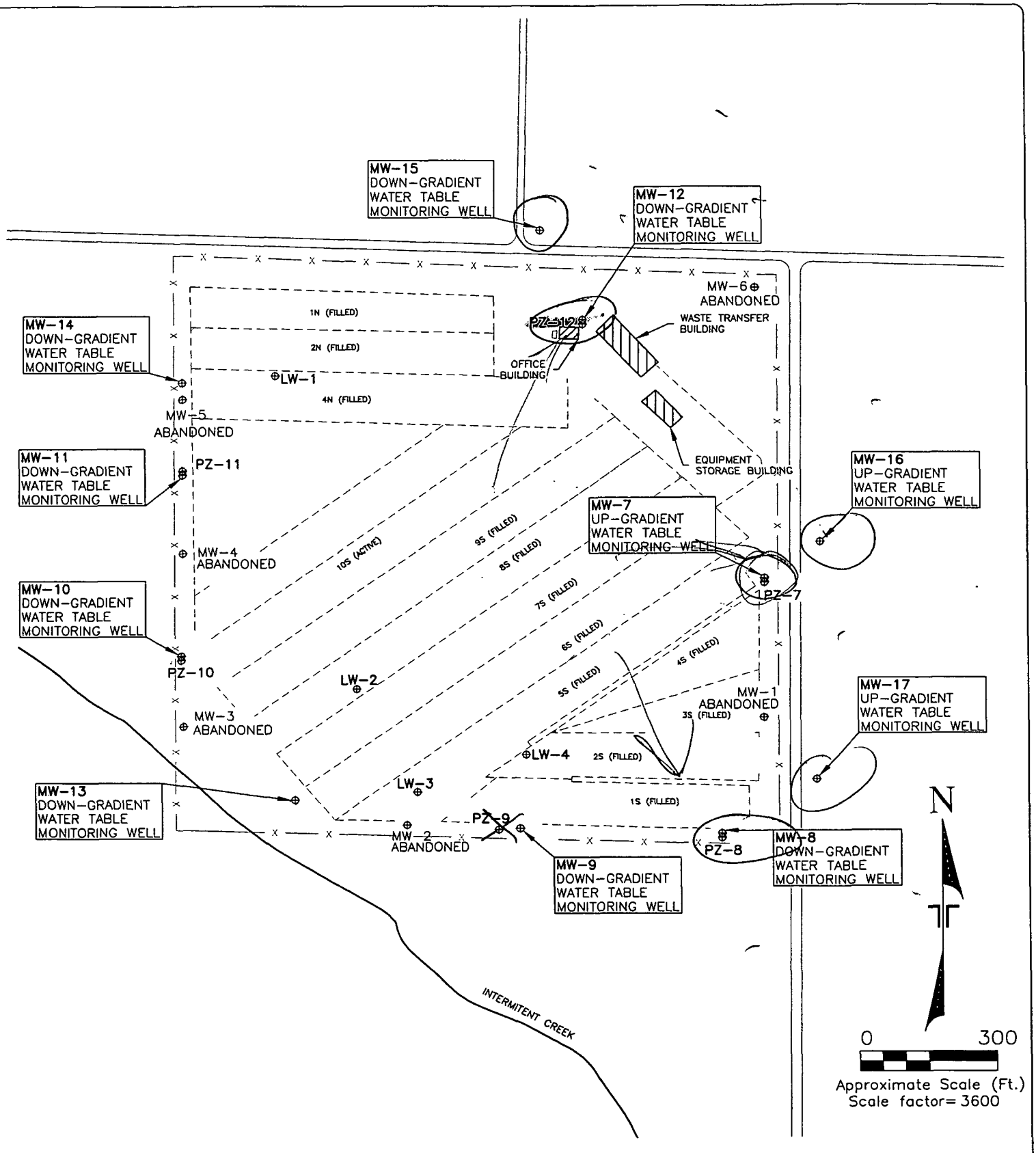
0 5000 FEET

NORTH

FIGURE 2
REGIONAL TOPOGRAPHIC MAP
Plymouth County Landfill
Plymouth County, Iowa
Job No. 40905033

Terracon

Form 101—1-87



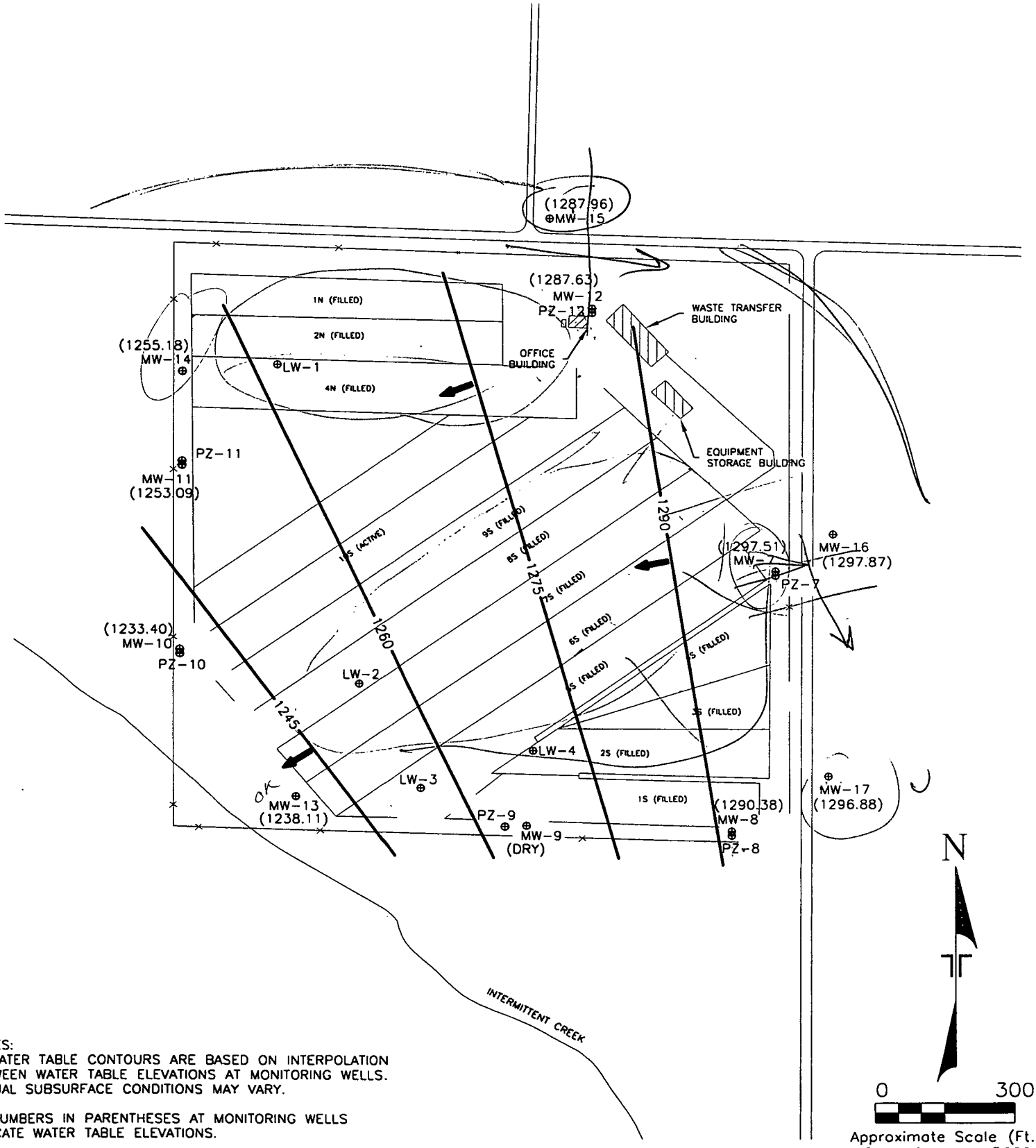

## LEGEND

- ⊕ MONITORING INSTRUMENT
- —— x —— FENCE LINE
- BUILDING

R3 DRK 10/21/98

HMSP
MONITORING WELL LOCATIONS
PLYMOUTH COUNTY LANDFILL
PLYMOUTH COUNTY, IOWA

| | | | |
|---|---|---|---|
| Project Mngr: RMB | Terracon | Project No. | 40905033 |
| Designed By: RMB | | Scale: | 1"=300' |
| Drawn By: JTW | 2211 S. 156th Circle Omaha, NE 68130 | File No. | 0E033R17 |
| Checked By: RMB | | Date: | OCTOBER 1998 |
| Approved By: DMS | Figure No. | | 3 |




NOTES:
1. WATER TABLE CONTOURS ARE BASED ON INTERPOLATION BETWEEN WATER TABLE ELEVATIONS AT MONITORING WELLS. ACTUAL SUBSURFACE CONDITIONS MAY VARY.

2. NUMBERS IN PARENTHESES AT MONITORING WELLS INDICATE WATER TABLE ELEVATIONS.

3. WATER TABLE ELEVATIONS ARE BASED ON MEASUREMENTS TAKEN ON JANUARY 20, 2003.

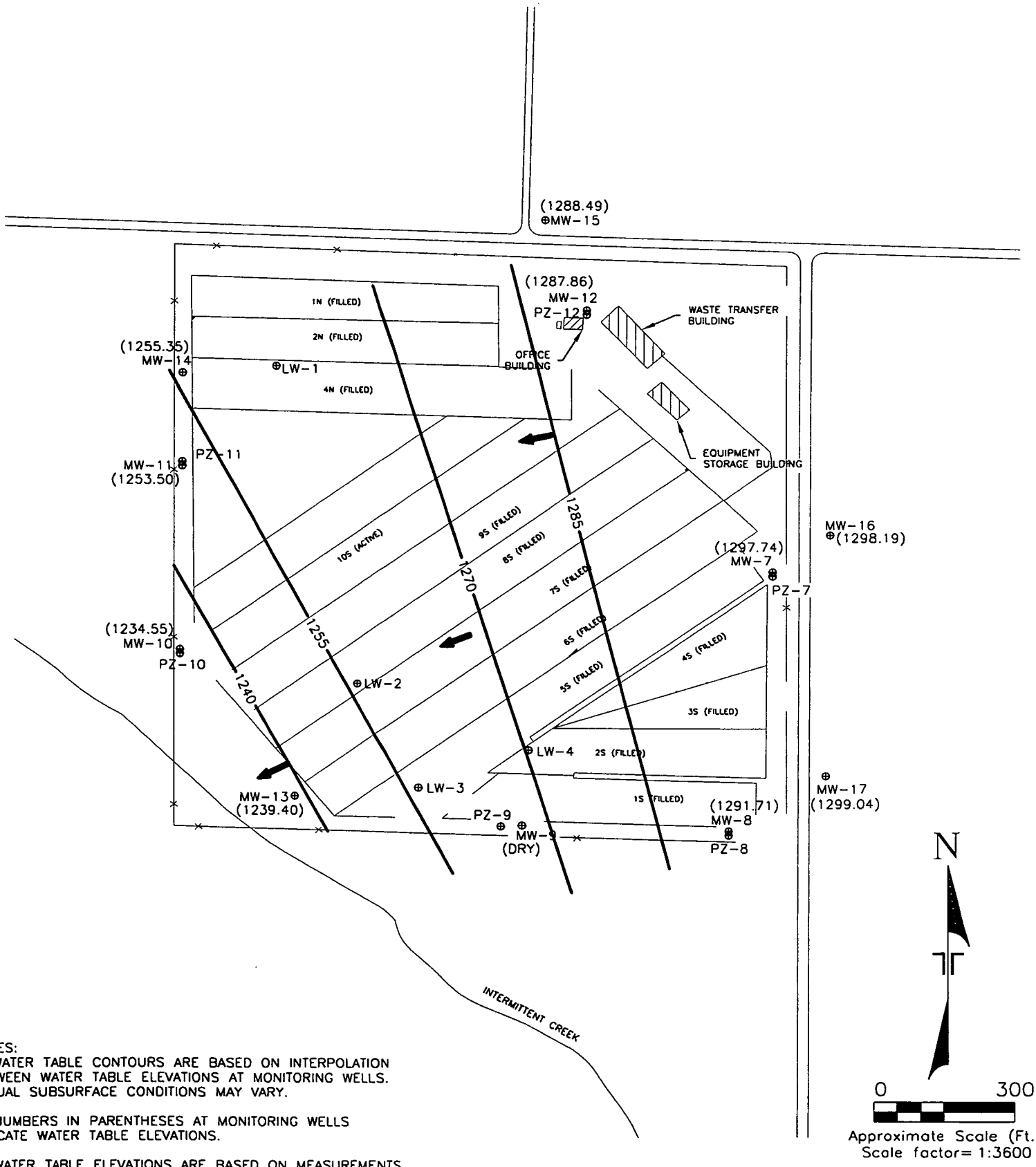
## LEGEND

- ⊕ MONITORING INSTRUMENT
- ➡ INFERRED GROUNDWATER FLOW DIRECTION
- —1275— WATER TABLE CONTOUR
- — x — FENCE LINE
- BUILDING

RS RSN 11/26/03

# WATER TABLE CONTOUR MAP
## JANUARY 20, 2003
PLYMOUTH COUNTY LANDFILL
PLYMOUTH COUNTY, IOWA

| | | | |
|---|---|---|---|
| Project Mngr: RMB | Terracon | | Project No. 40905033 |
| Designed By: RMB | | | Scale: AS SHOWN |
| Drawn By: RSN | 2211 S. 156th Circle Omaha, NE 68130 | | File No. 0E033R35 |
| Checked By: RMB | | | Date: NOV. 2003 |
| Approved By: DMS | | Figure No. | 4 |




NOTES:
1. WATER TABLE CONTOURS ARE BASED ON INTERPOLATION BETWEEN WATER TABLE ELEVATIONS AT MONITORING WELLS. ACTUAL SUBSURFACE CONDITIONS MAY VARY.

2. NUMBERS IN PARENTHESES AT MONITORING WELLS INDICATE WATER TABLE ELEVATIONS.

3. WATER TABLE ELEVATIONS ARE BASED ON MEASUREMENTS TAKEN ON JULY 17, 2003.

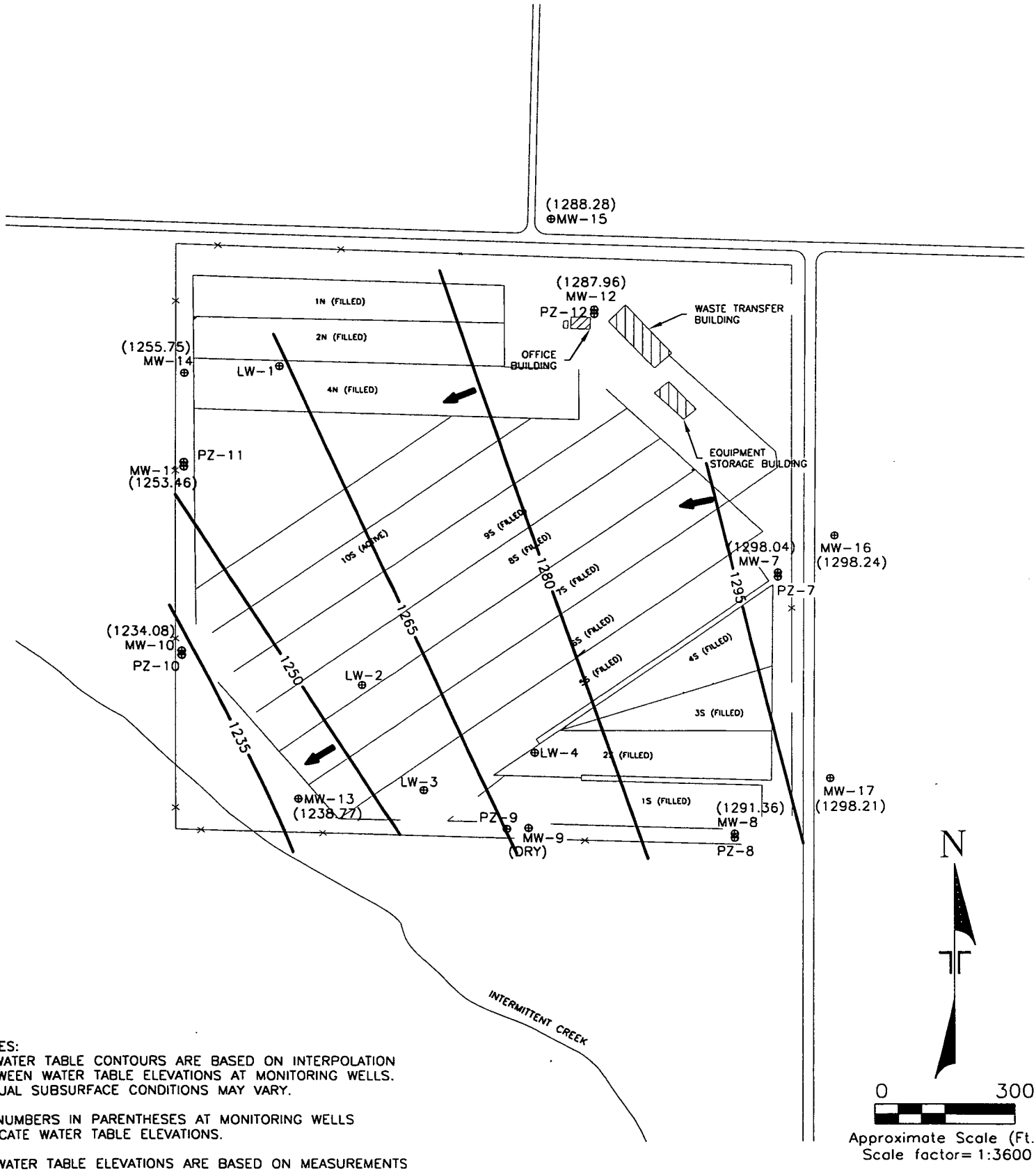
## LEGEND

- ⊕ MONITORING INSTRUMENT
- ➡ INFERRED GROUNDWATER FLOW DIRECTION
- —1270— WATER TABLE CONTOUR
- — x — FENCE LINE
- BUILDING

R5 RSN 11/25/02

# WATER TABLE CONTOUR MAP
## JULY 17, 2003
## PLYMOUTH COUNTY LANDFILL
## PLYMOUTH COUNTY, IOWA

| | | | |
|---|---|---|---|
| Project Mngr: RMB | Terracon | | Project No. 40905033 |
| Designed By: RMB | | | Scale: AS SHOWN |
| Drawn By: RSN | 2211 S. 156th Circle Omaha, NE 68130 | | File No. 0E033R36 |
| Checked By: RMB | | | Date: NOV. 2003 |
| Approved By: DMS | | Figure No. | 5 |




NOTES:
1. WATER TABLE CONTOURS ARE BASED ON INTERPOLATION BETWEEN WATER TABLE ELEVATIONS AT MONITORING WELLS. ACTUAL SUBSURFACE CONDITIONS MAY VARY.

2. NUMBERS IN PARENTHESES AT MONITORING WELLS INDICATE WATER TABLE ELEVATIONS.

3. WATER TABLE ELEVATIONS ARE BASED ON MEASUREMENTS TAKEN ON SEPTEMBER 16, 2003.

## LEGEND

- ⊕ MONITORING INSTRUMENT
- ➡ INFERRED GROUNDWATER FLOW DIRECTION
- —1265— WATER TABLE CONTOUR
- —— x —— FENCE LINE
- BUILDING

R5 RSN 11/25/02

# WATER TABLE CONTOUR MAP
## SEPTEMBER 16, 2003
## PLYMOUTH COUNTY LANDFILL
## PLYMOUTH COUNTY, IOWA

| | | | |
|---|---|---|---|
| Project Mngr: RMB | Terracon | | Project No. 40905033 |
| Designed By: RMB | | | Scale: AS SHOWN |
| Drawn By: RSN | 2211 S. 156th Circle Omaha, NE 68130 | | File No. 0E033R37 |
| Checked By: RMB | | | Date: NOV. 2003 |
| Approved By: DMS | | Figure No. | 6 |

**ANALYSIS SHEET MW-17**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**TERRACON PROJECT NO. 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

# Appendix B

***SAMPLE LOCATION NO.*** ***MW-17 (Up-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-17 Standard Deviation | MW-17 Mean | 10/4/1997 | 11/10/1997 | 1/8/1998 | 4/22/1998 | 7/1/1998 | 10/19/1998 | 4/30/1999 | 9/1/1999 | 4/12/2000 | 10/17/2000 | 4/25/2001 | 10/23/2001 | 4/28/2002 | 10/6/2002 |
| **Laboratory Parameters** | | | | | | | | | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 1.239 | 2.820 | - | **2.5** | **2.5** | **2.5** | 7.3 | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 2.465 | 3.400 | - | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **11** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.100 | - | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.000 | 0.050 | - | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** |
| Benzene (µg/l) | 0.25 | 0.25 | 0.000 | 0.250 | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.20 | 0.20 | 0.000 | 0.200 | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.00 | 1.00 | 0.000 | 1.000 | **1.0** | **1.0** | **1.0** | **1.0** | **1.0** | **1.0** | - | **1.0** | **1.0** | - | - | - | **1.0** | **1.0** |
| 1,1,1-Trichloroethane (ug/l) | 0.50 | 0.50 | 0.000 | 0.500 | - | **0.5** | **0.5** | - | - | - | - | - | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.50 | 0.50 | 0.000 | 0.500 | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | - | - | - | - | - | **0.01** | - | **0.01** | - | **0.01** | - | **0.01** | **0.01** | **0.01** |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.000 | 0.005 | - | - | - | - | - | **0.005** | - | **0.005** | - | **0.005** | - | **0.005** | **0.005** | **0.005** |
| **Field Parameters** | | | | | | | | | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.64 | 7.0 | - | - | - | 7.0 | 7.0 | 6.8 | 6.8 | 6.8 | 7 | 5.1 | 7.5 | 7.5 | 6.9 | 7.4 |
| Specific Conductance (umhos/cm) | 570 | 323 | 61.6 | 446 | - | - | - | 408 | 450 | 444 | 449 | 449 | 465 | 440 | 511 | 473 | 427 | 417 |

**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-17

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

***SAMPLE LOCATION NO.*** ***MW-17*** ***(Up-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | |
|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-17 Standard Deviation | MW-17 Mean | 4/3/2003 | 10/7/2003 |
| **Laboratory Parameters** | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 1.239 | 2.820 | **2.5** | **2.5** |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 2.465 | 3.400 | 7.5 | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.100 | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.000 | 0.050 | **0.05** | **0.05** |
| Benzene (µg/l) | 0.25 | 0.25 | 0.000 | 0.250 | **0.25** | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.20 | 0.20 | 0.000 | 0.200 | **0.2** | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.00 | 1.00 | 0.000 | 1.000 | **1.0** | **1.0** |
| 1,1,1-Trichloroethane (ug/l) | 0.50 | 0.50 | 0.000 | 0.500 | - | **0.5** |
| Trichloroethene (µg/l) | 0.50 | 0.50 | 0.000 | 0.500 | **0.5** | **0.5** |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | **0.01** | - |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.000 | 0.005 | **0.005** | - |
| **Field Parameters** | | | | | | |
| pH | 8.2 | 5.7 | 0.64 | 7.0 | 7.3 | 7.6 |
| Specific Conductance (umhos/cm) | 570 | 323 | 61.6 | 446 | 299 | 572 |

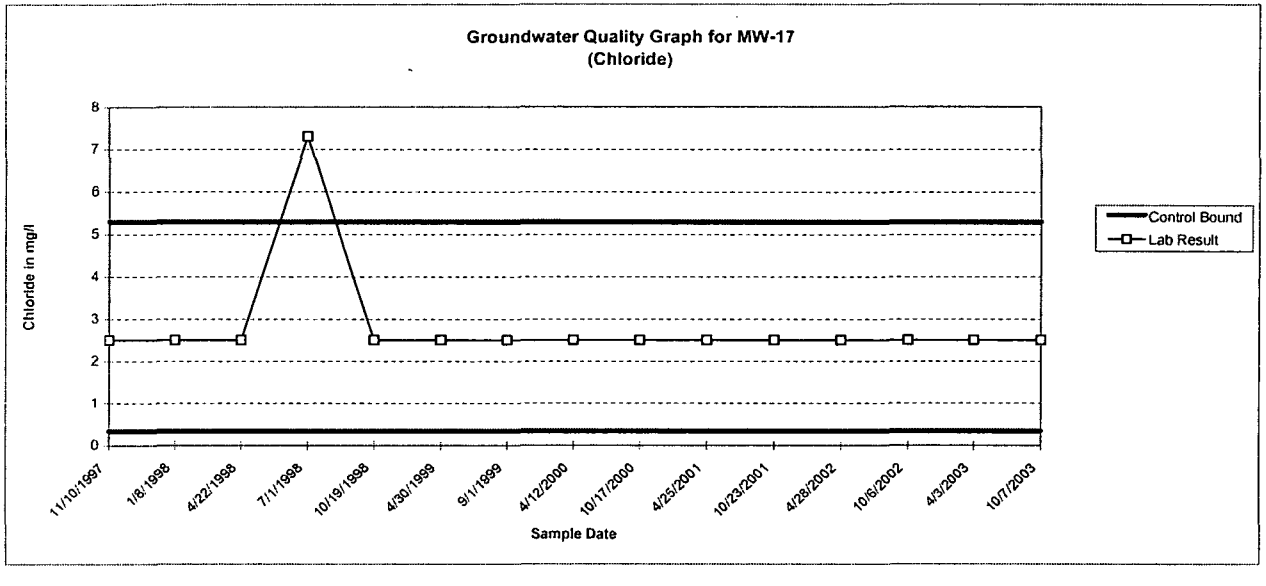
**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

**ANALYSIS SHEET MW-17**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**TERRACON PROJECT NO. 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

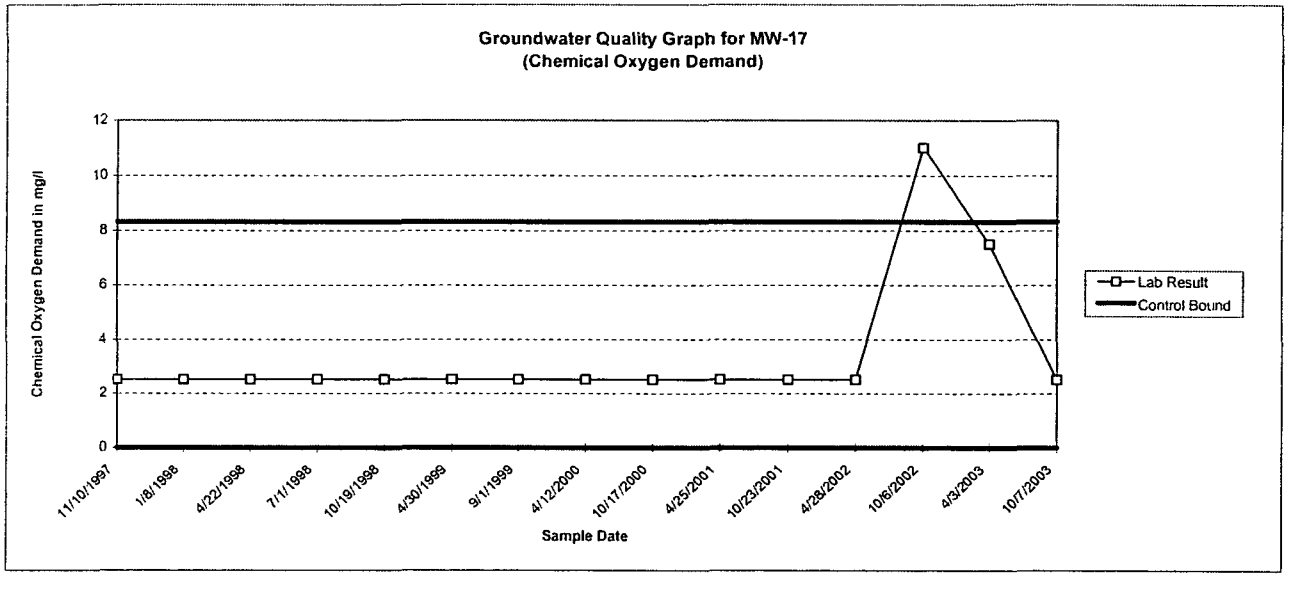



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) One-half of the MDL was plotted for non-detectable parameters.

**ANALYSIS SHEET MW-17**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**TERRACON PROJECT NO. 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**




NOTE:
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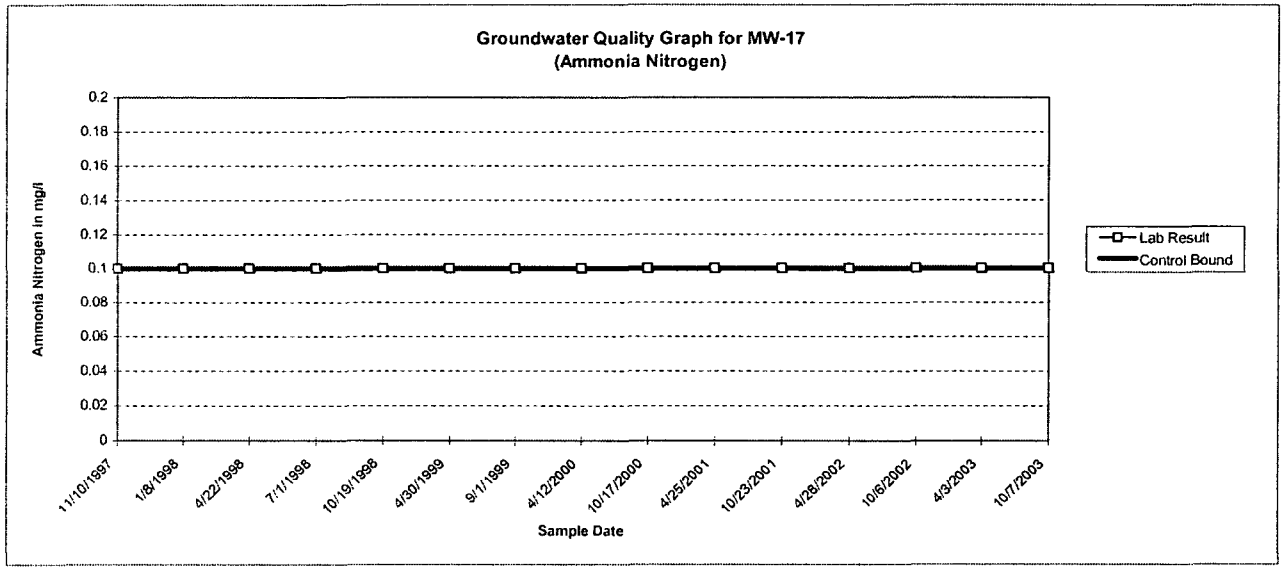
2) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-17

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

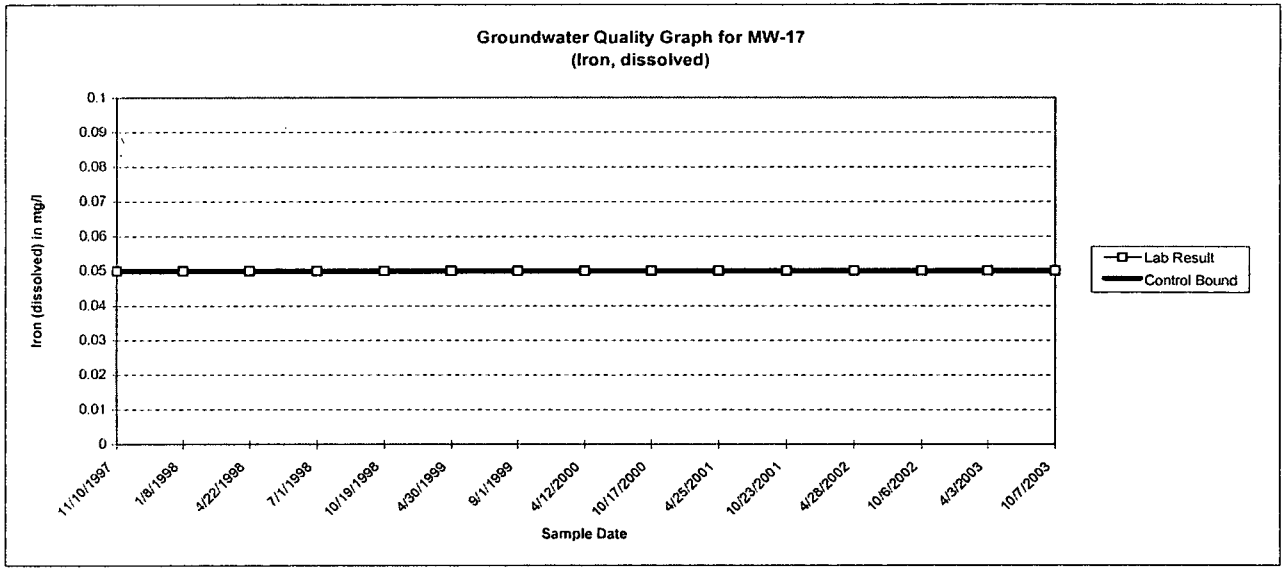



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-17

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

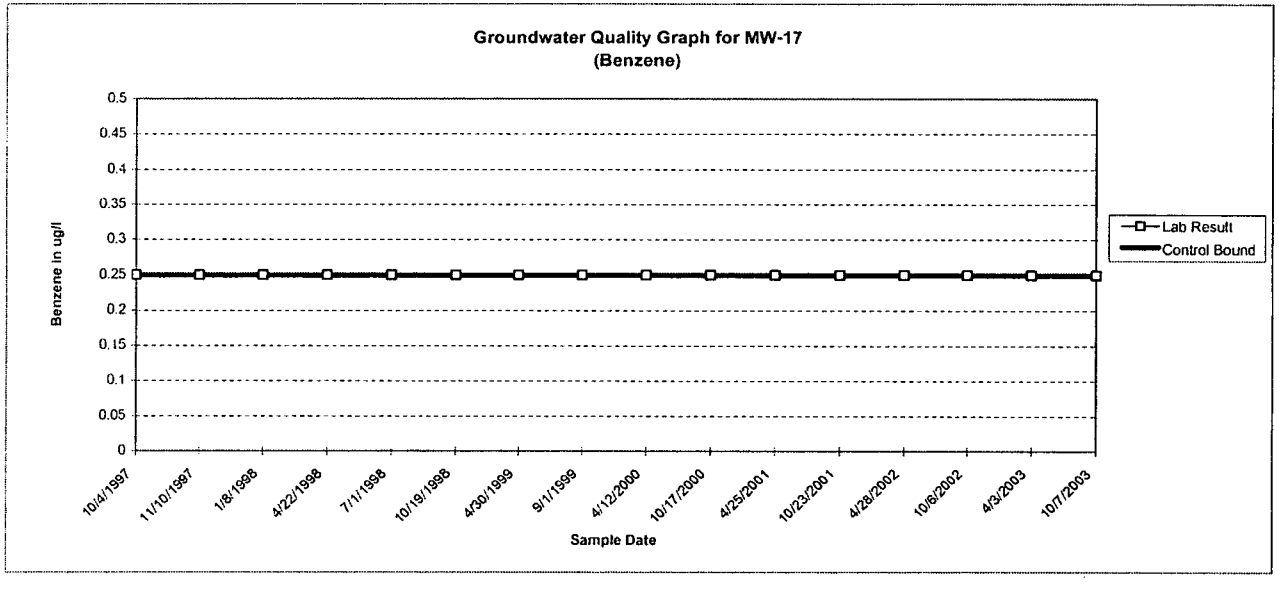



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-17

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
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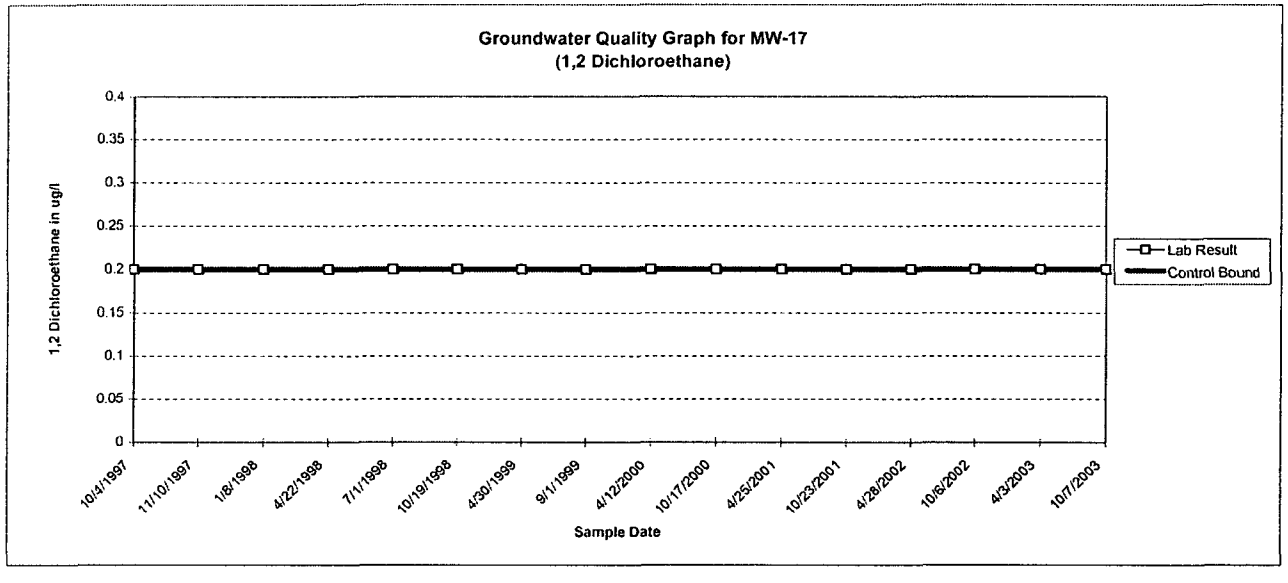
**ANALYSIS SHEET MW-17**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**TERRACON PROJECT NO. 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

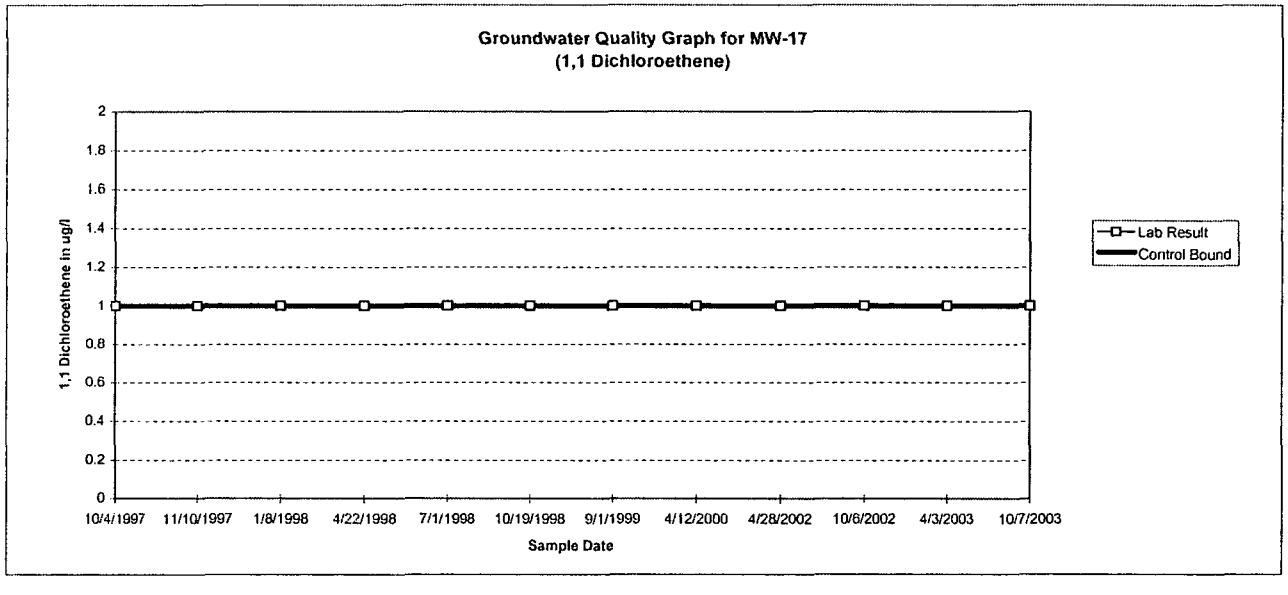



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

**ANALYSIS SHEET MW-17**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**TERRACON PROJECT NO. 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

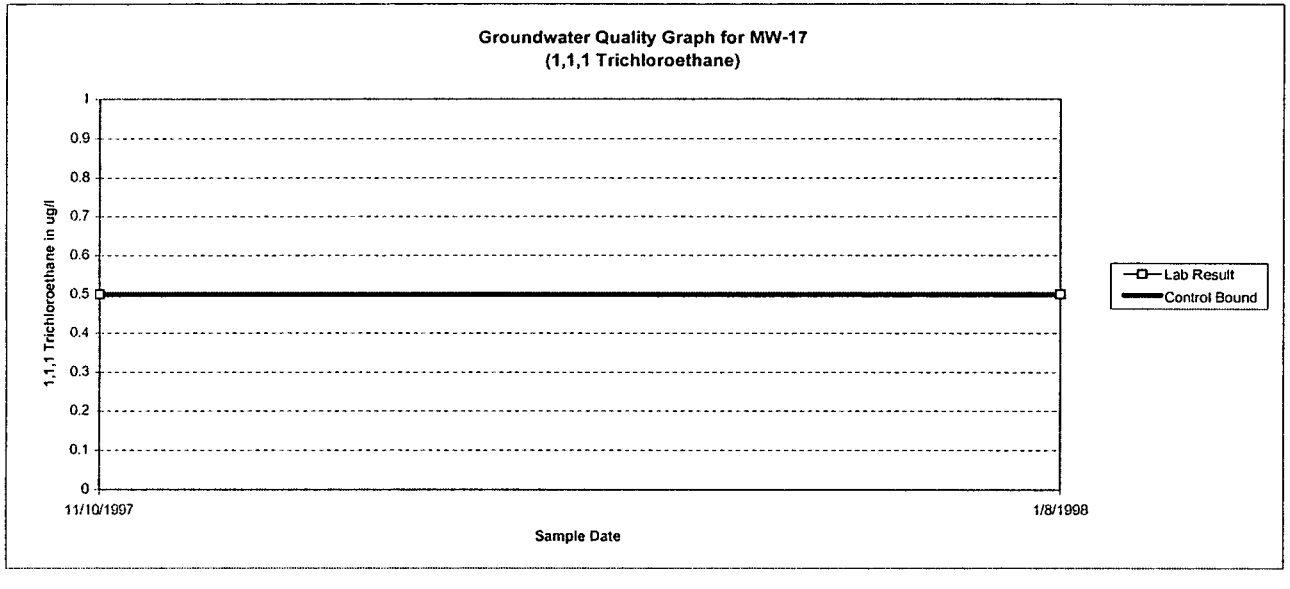



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

**ANALYSIS SHEET MW-17**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**TERRACON PROJECT NO. 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
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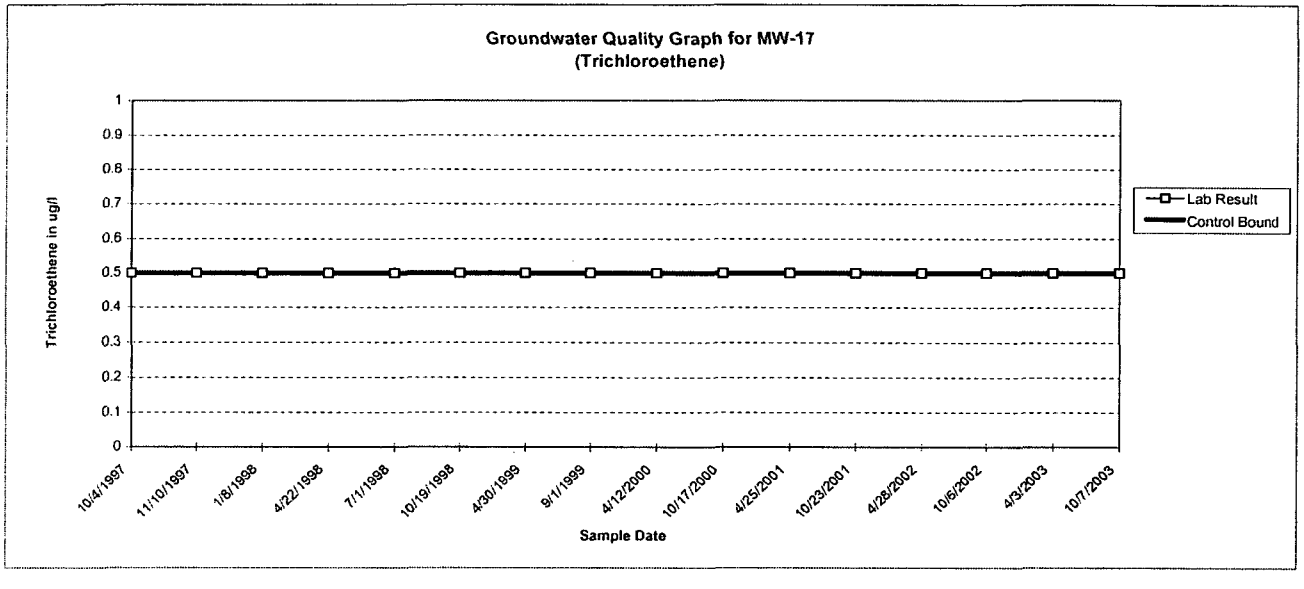
## ANALYSIS SHEET MW-17

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

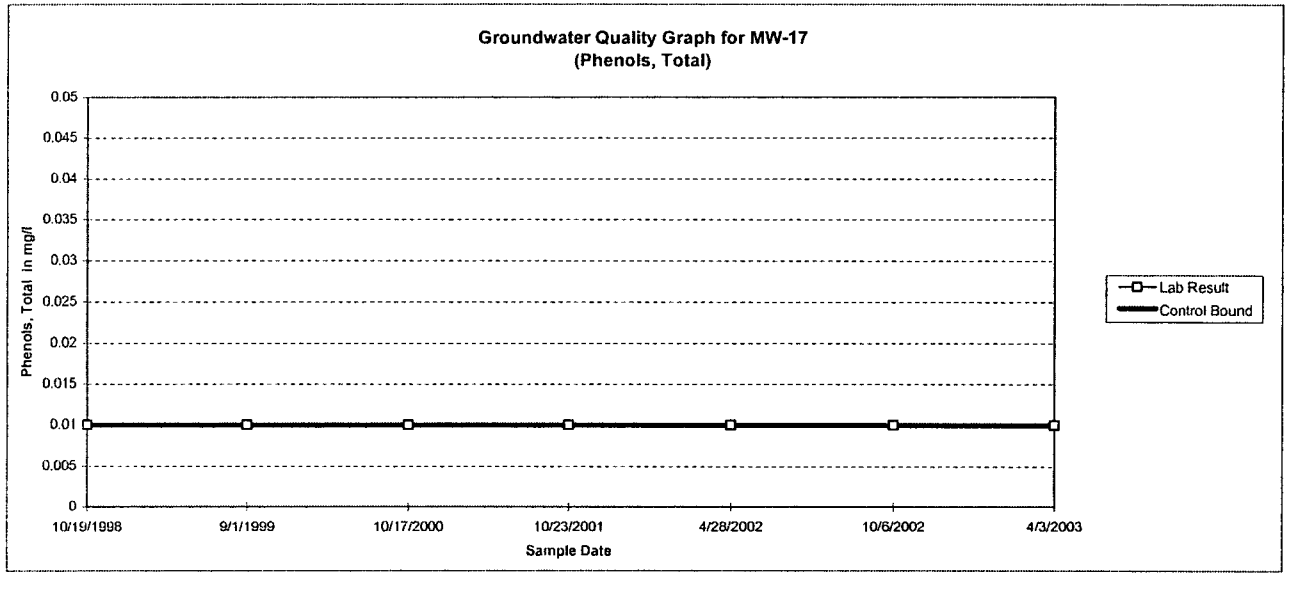



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

**ANALYSIS SHEET MW-17**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**TERRACON PROJECT NO. 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

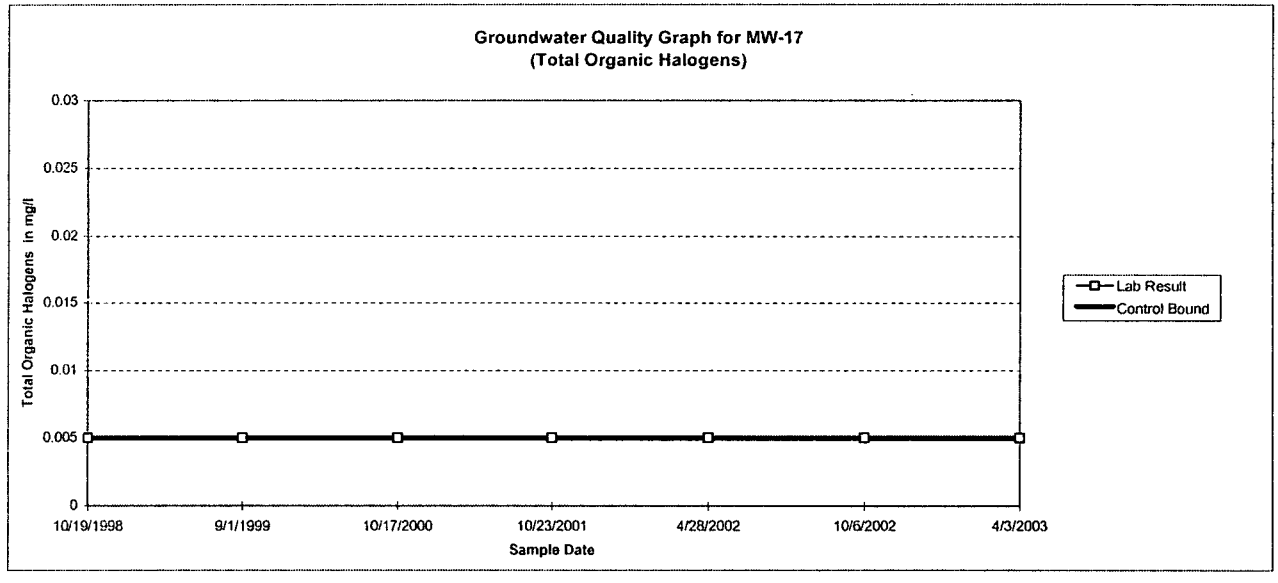



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

**ANALYSIS SHEET MW-17**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**TERRACON PROJECT NO. 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

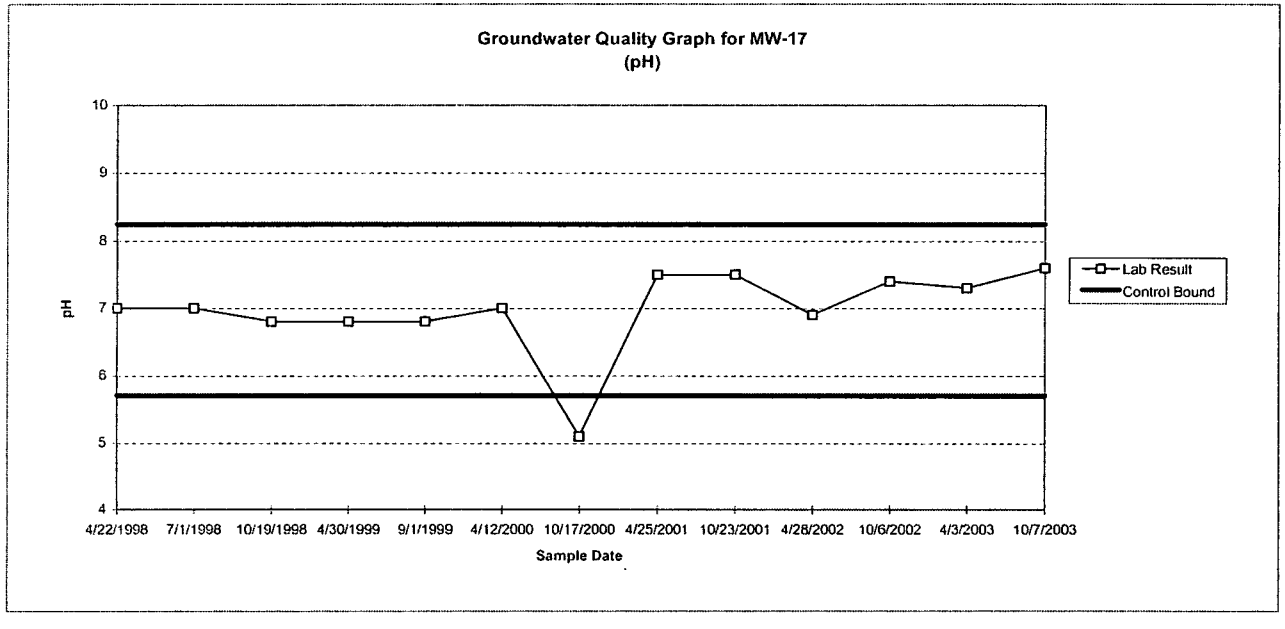



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-17

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

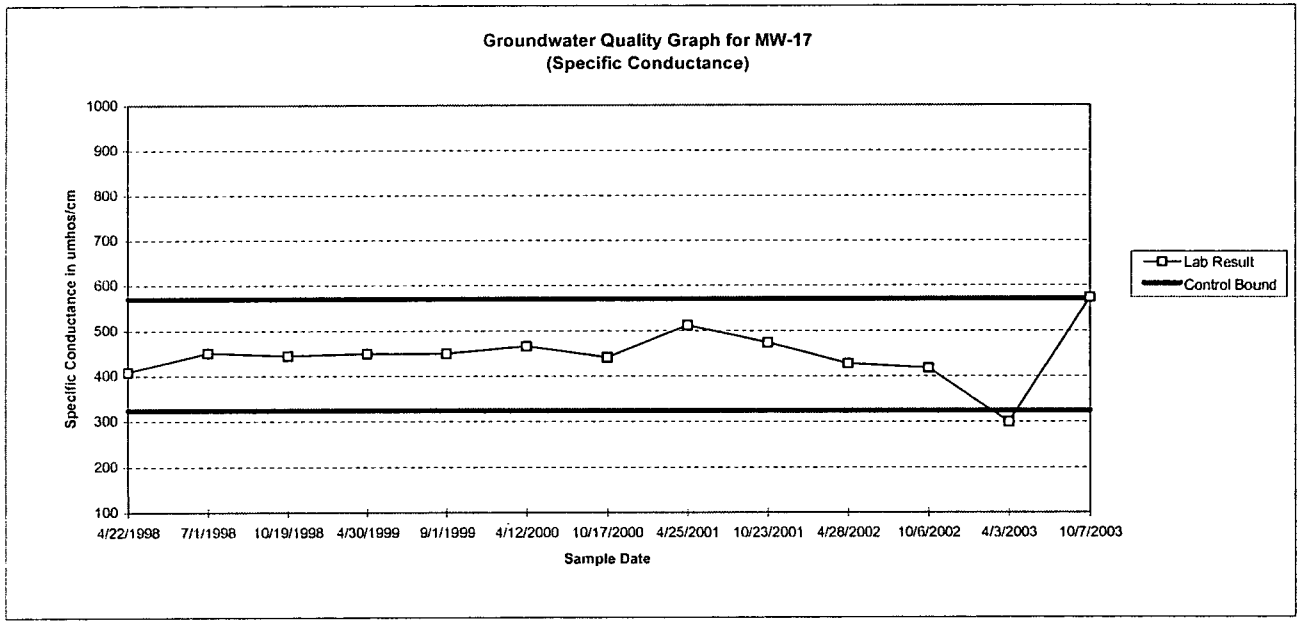



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-17

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-16

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

***SAMPLE LOCATION NO.*** ***MW-16 (Up-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-16 Standard Deviation | MW-16 Mean | 10/4/1997 | 4/22/1998 | 10/19/1998 | 4/30/1999 | 9/1/1999 | 4/12/2000 | 10/17/2000 | 4/25/2001 | 10/23/2001 |
| **Laboratory Parameters** | | | | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 1.955 | 4.667 | - | - | - | - | - | - | - | 5.2 | **2.5** |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 0.000 | 2.500 | - | - | - | - | - | - | - | **2.5** | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.100 | - | - | - | - | - | - | - | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.000 | 0.050 | - | - | - | - | - | - | - | 0.05 | 0.05 |
| Benzene (µg/l) | 0.250 | 0.250 | 0.000 | 0.250 | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.000 | 0.200 | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.000 | 1.000 | **1.0** | **1.0** | **1.0** | - | **1.0** | **1.0** | - | - | - |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | | | - | - | - | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.000 | 0.500 | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | - | - | - | - | - | - | **0.01** | - | **0.01** |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.000 | 0.005 | - | - | - | - | - | - | **0.005** | - | **0.005** |
| **Field Parameters** | | | | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.5 | 6.9 | - | 6.9 | 6.7 | 6.5 | 6.1 | 6.3 | 6.7 | 7.4 | 7.3 |
| Specific Conductance (umhos/cm) | 570 | 323 | 61 | 443 | - | 448 | 473 | 500 | 546 | 445 | 346 | 409 | 487 |

**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-16

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

***SAMPLE LOCATION NO.*** ***MW-16*** ***(Up-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | |
|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-16 Standard Deviation | MW-16 Mean | 4/28/2002 | 10/6/2002 | 4/3/2003 | 10/7/2003 |
| **Laboratory Parameters** | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 1.955 | 4.667 | - | - | - | 6.3 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 0.000 | 2.500 | - | - | - | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.100 | - | - | - | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.000 | 0.050 | - | - | - | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.000 | 0.250 | **0.25** | **0.25** | **0.25** | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.000 | 0.200 | **0.2** | **0.2** | **0.2** | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.000 | 1.000 | **1.0** | **1.0** | **1.0** | **1.0** |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | | | - | - | | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.000 | 0.500 | **0.5** | **0.5** | **0.5** | **0.5** |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | - | - | - | - |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.000 | 0.005 | - | - | - | - |
| **Field Parameters** | | | | | | | | |
| pH | 8.2 | 5.7 | 0.5 | 6.9 | 7 | 7.4 | 7.3 | 7.6 |
| Specific Conductance (umhos/cm) | 570 | 323 | 61 | 443 | 450 | 403 | 466 | 339 |

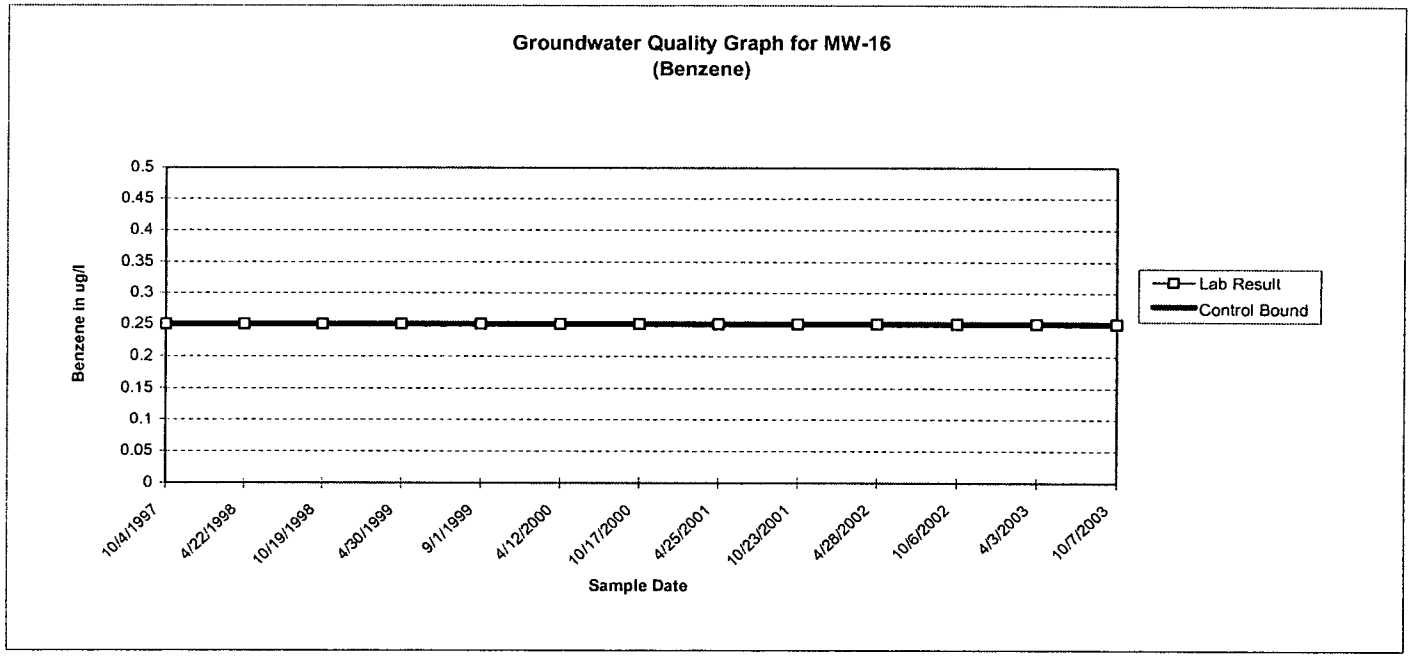
NOTE:

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limIt of zero (0) was used for those parameters in which a negative lower control limIt was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-16

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

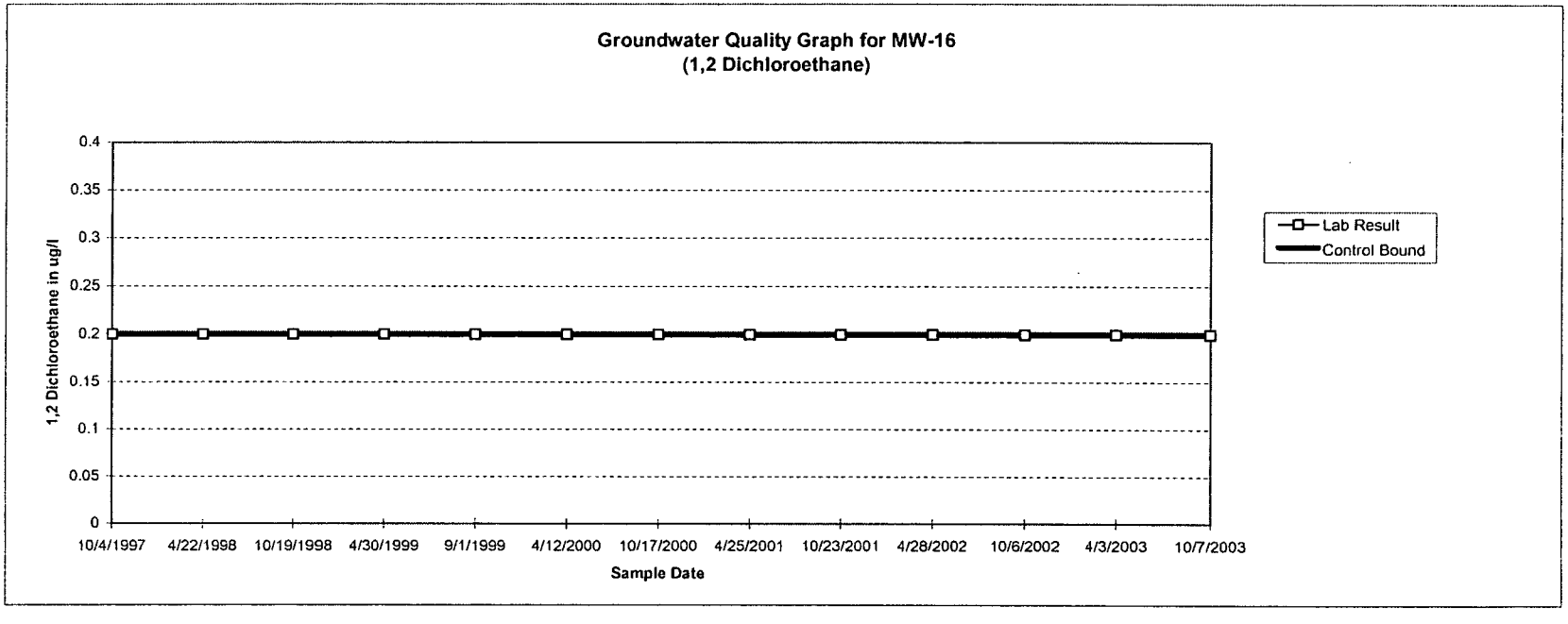



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-16

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
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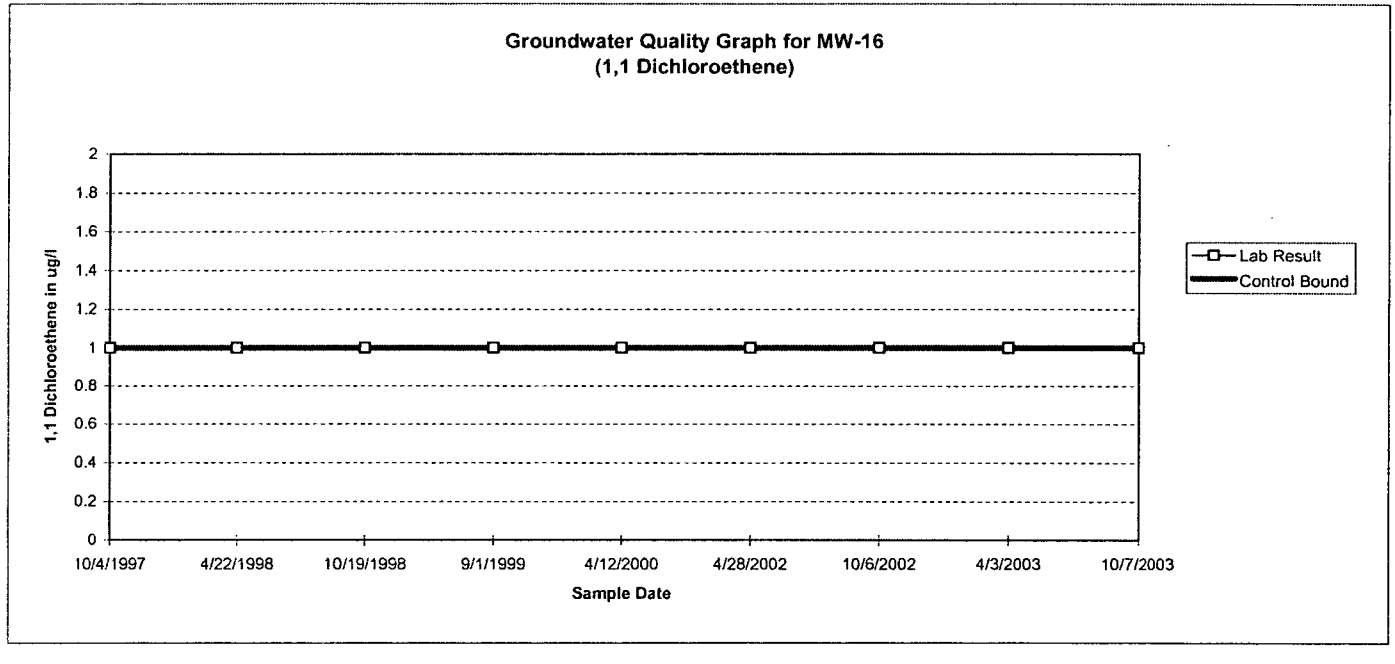
## ANALYSIS SHEET MW-16

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

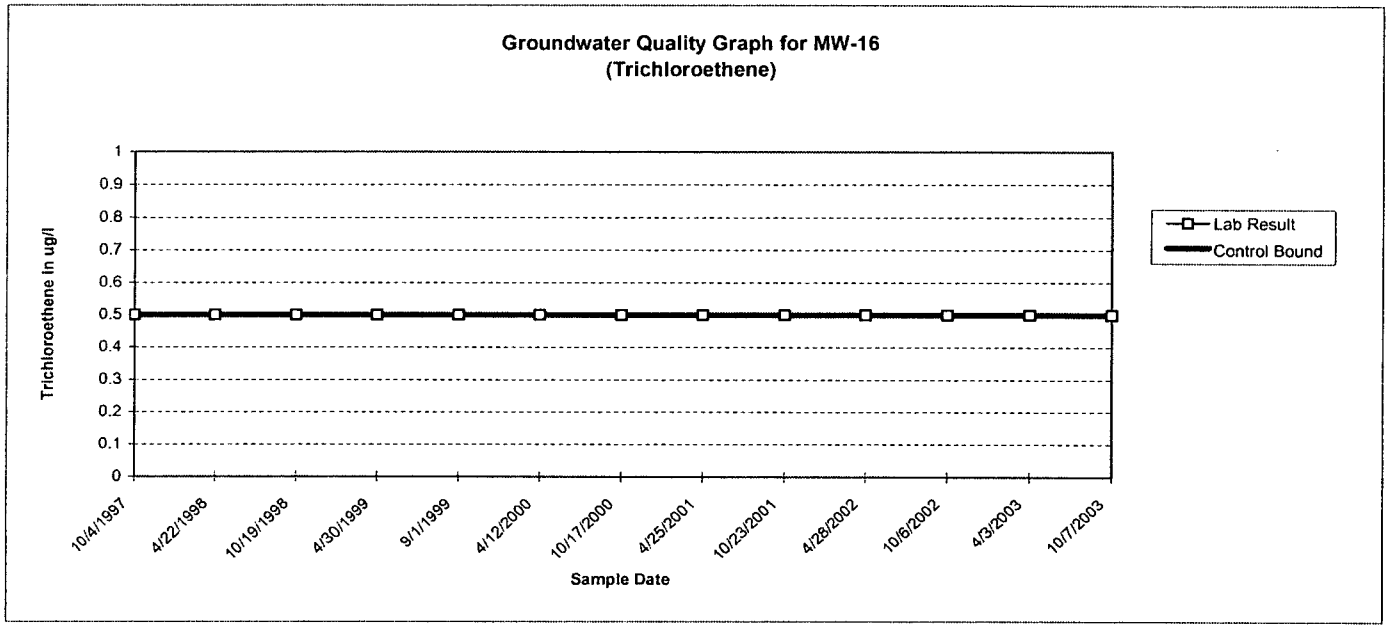



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-16

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
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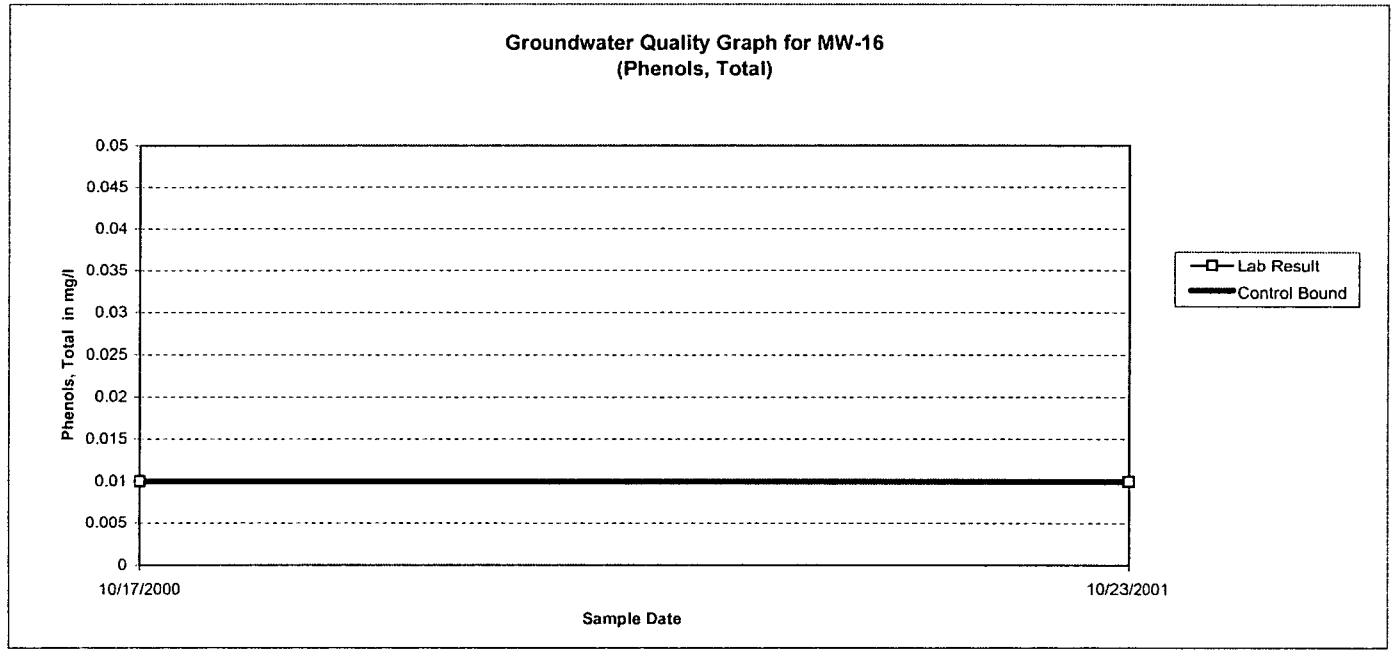
## ANALYSIS SHEET MW-16

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
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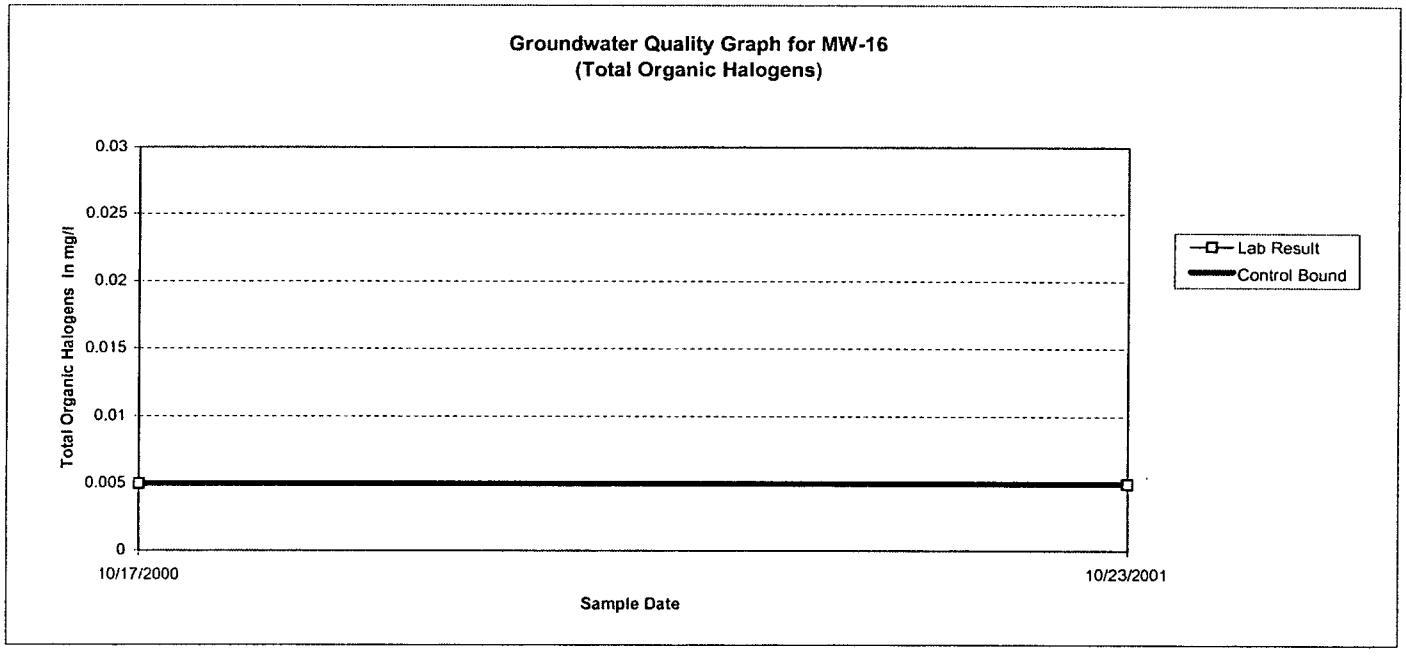
## ANALYSIS SHEET MW-16

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

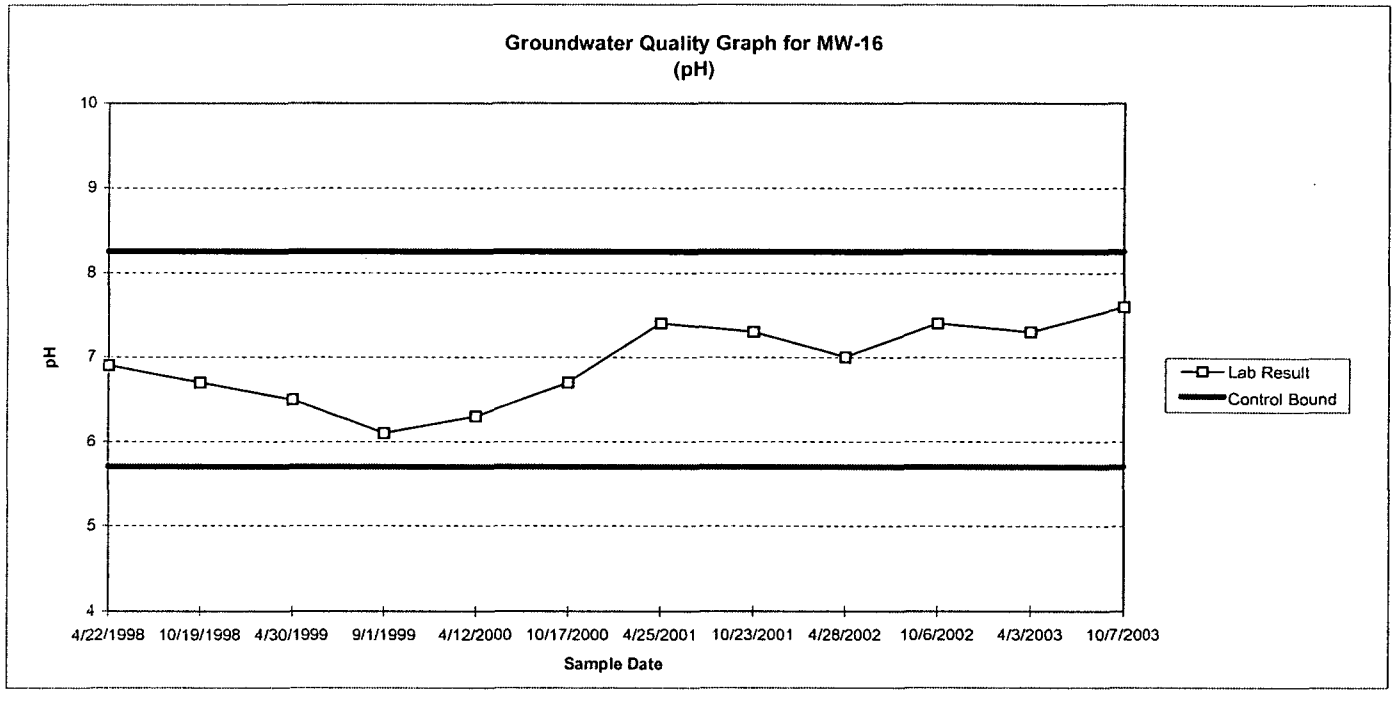



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-16

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

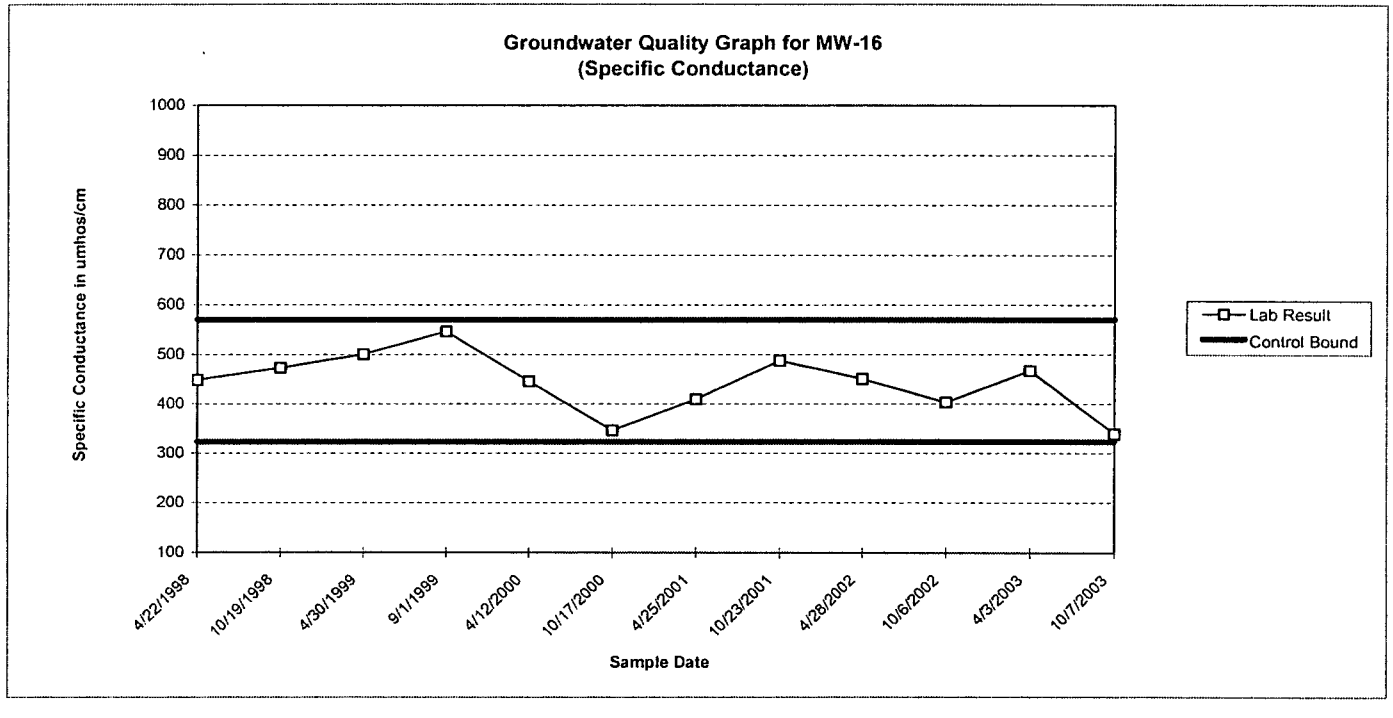



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-16

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-15

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

***SAMPLE LOCATION NO.*** ***MW-15*** ***(Down-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-15 Standard Deviation | MW-15 Mean | 10/4/1997 | 4/27/1998 | 10/19/1998 | 4/30/1999 | 9/1/1999 | 4/12/2000 | 10/17/2000 | 4/25/2001 | 10/24/2001 | 4/28/2002 | 10/6/2002 |
| **Laboratory Parameters** | | | | | | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 0.173 | 8.500 | - | - | - | - | - | - | - | 8.3 | 8.6 | - | - |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 6.640 | 6.333 | - | - | - | - | - | - | - | 14 | **2.5** | - | - |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.100 | - | - | - | - | - | - | - | **0.1** | **0.1** | - | - |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.614 | 0.500 | - | - | - | - | - | - | - | 1.2 | **0.05** | - | - |
| Benzene (µg/l) | 0.250 | 0.250 | 0.000 | 0.250 | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.000 | 0.200 | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.000 | 1.000 | **1.0** | **1.0** | **1.0** | - | **1.0** | **1.0** | - | - | - | **1.0** | **1.0** |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.411 | 1.062 | **0.5** | **0.5** | **0.5** | **0.5** | 1.3 | 1.3 | 1.1 | 1.6 | 1.3 | 1.3 | 1.13 |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | - | - | - | - | - | - | **0.01** | - | **0.01** | - | - |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.001 | 0.022 | - | - | - | - | - | - | 0.021 | - | 0.022 | - | - |
| **Field Parameters** | | | | | | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.3 | 6.4 | - | 6.5 | 6.5 | 6.2 | 6.0 | 6.0 | 5.9 | 6.7 | 6.7 | 6.4 | 6.7 |
| Specific Conductance (umhos/cm) | 570 | 323 | 351 | 740 | - | 824 | 824 | 879 | 1012 | 925 | 969 | 721 | 10.75 | 9.03 | 886 |

NOTE:

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limIt of zero (0) was used for those parameters in which a negative lower control limIt was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-15

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

***SAMPLE LOCATION NO.*** ***MW-15*** ***(Down-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | |
|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-15 Standard Deviation | MW-15 Mean | 4/3/2003 | 10/7/2003 |
| **Laboratory Parameters** | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 0.173 | 8.500 | - | 8.6 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 6.640 | 6.333 | - | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.100 | - | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.614 | 0.500 | - | **0.25** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.000 | 0.250 | **0.25** | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.000 | 0.200 | **0.2** | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.000 | 1.000 | **1.0** | **1.0** |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.411 | 1.062 | 1.5 | 1.28 |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | - | - |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.001 | 0.022 | - | - |
| **Field Parameters** | | | | | | |
| pH | 8.25 | 5.71 | 0.3 | 6.4 | 6.8 | 6.5 |
| Specific Conductance (umhos/cm) | 569.6 | 323.3 | 351 | 740 | 994 | 824 |

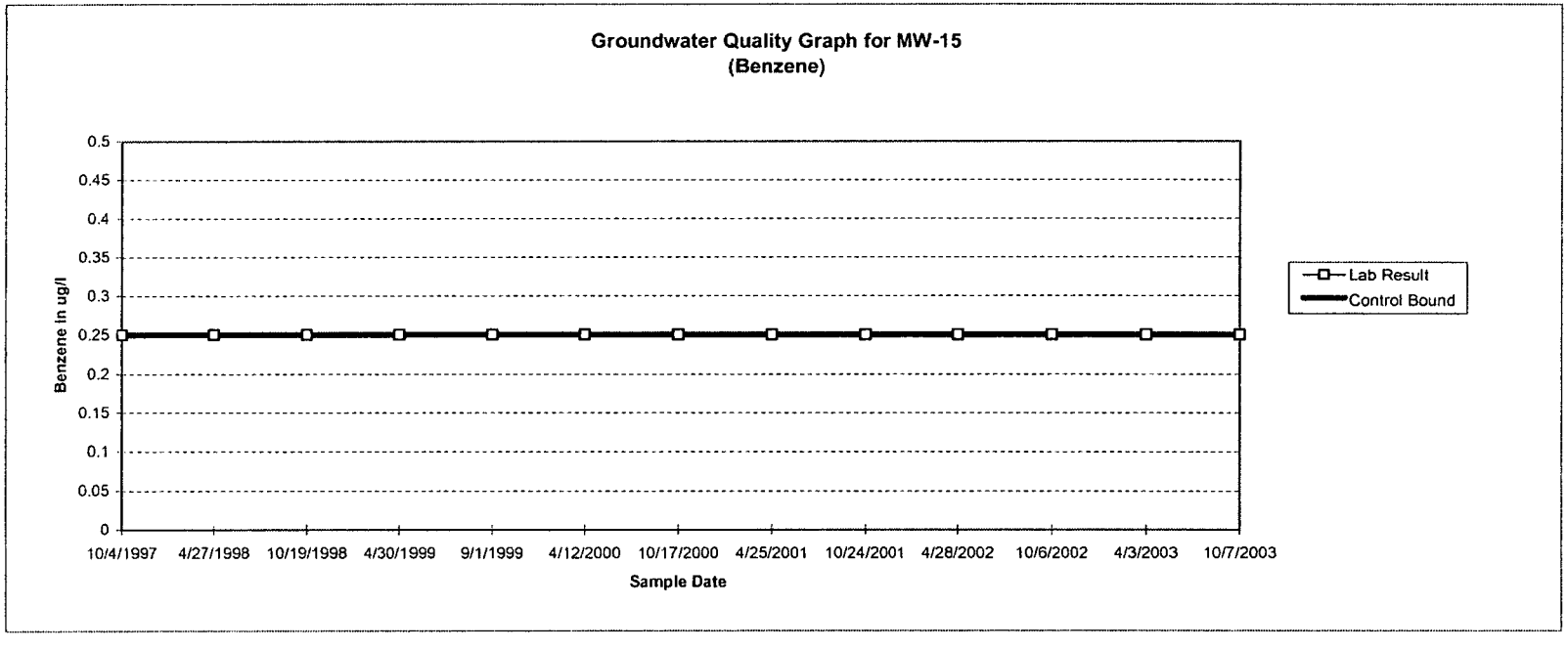
NOTE:

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-15

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

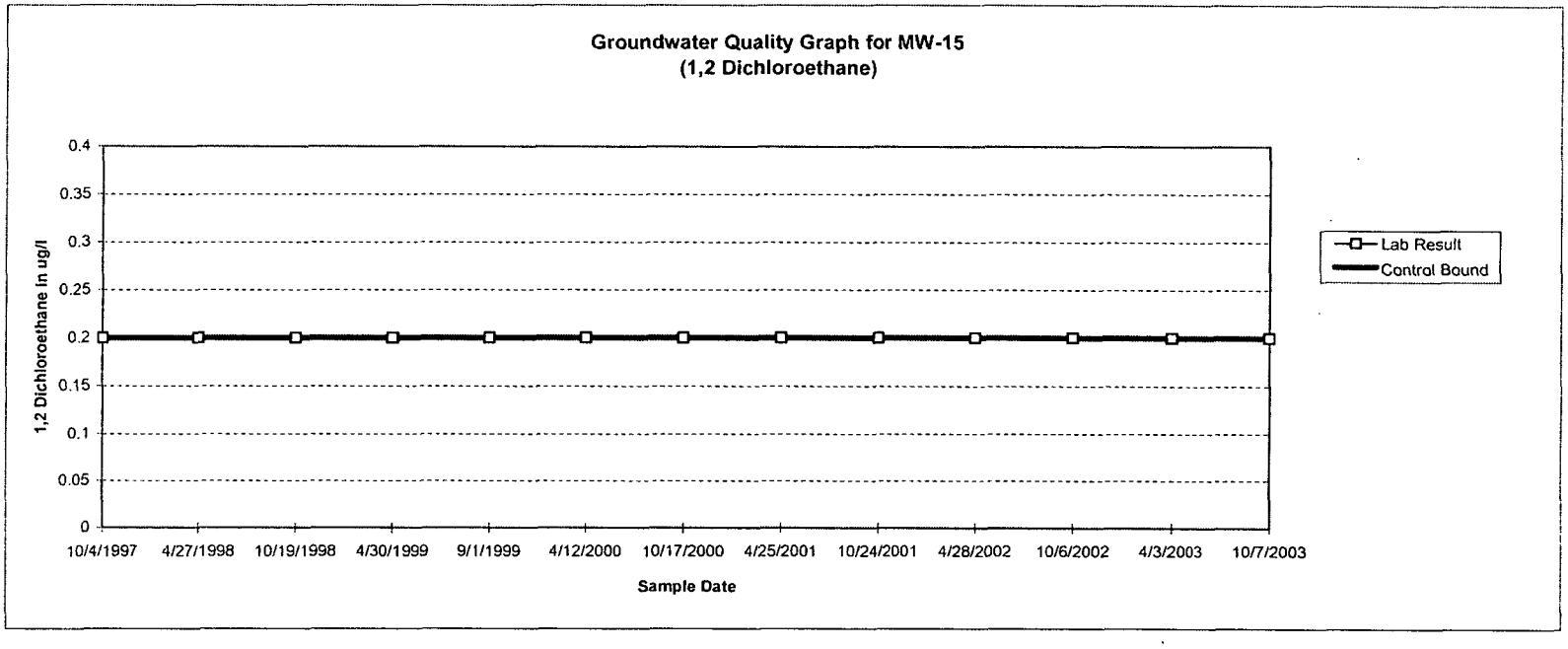



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-15

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

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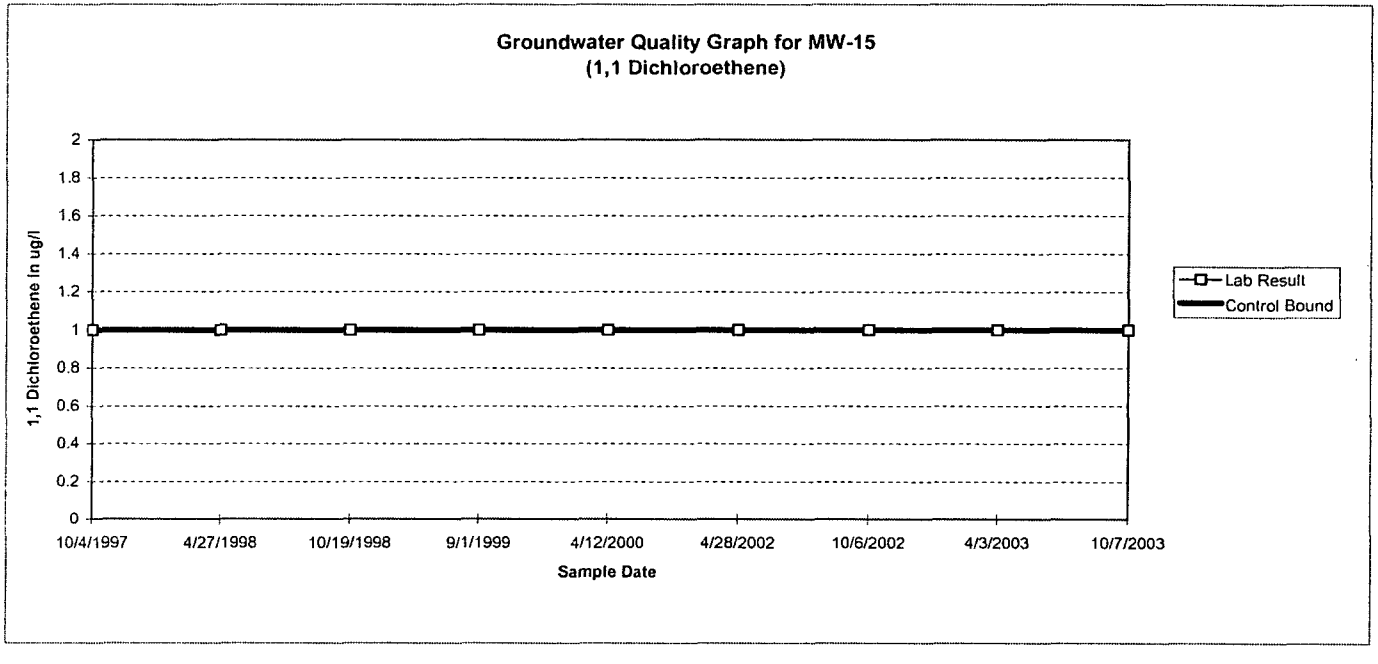
## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

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## GROUNDWATER SAMPLING AND ANALYSIS
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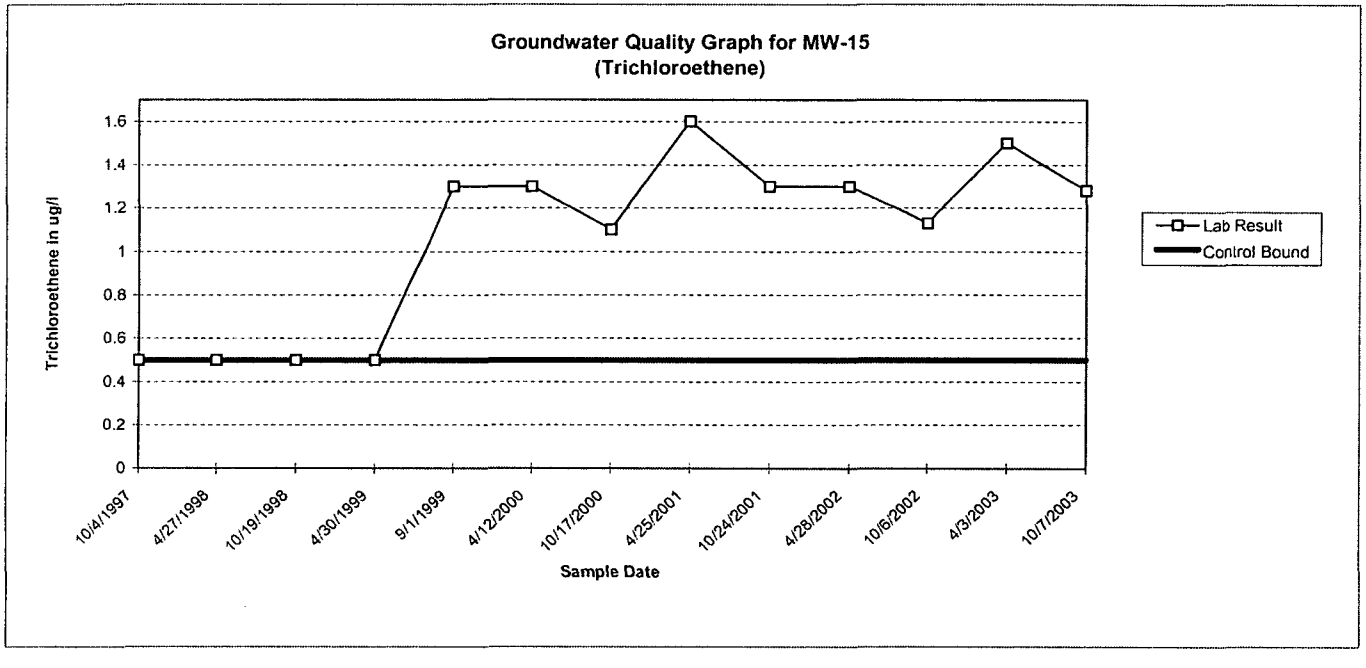


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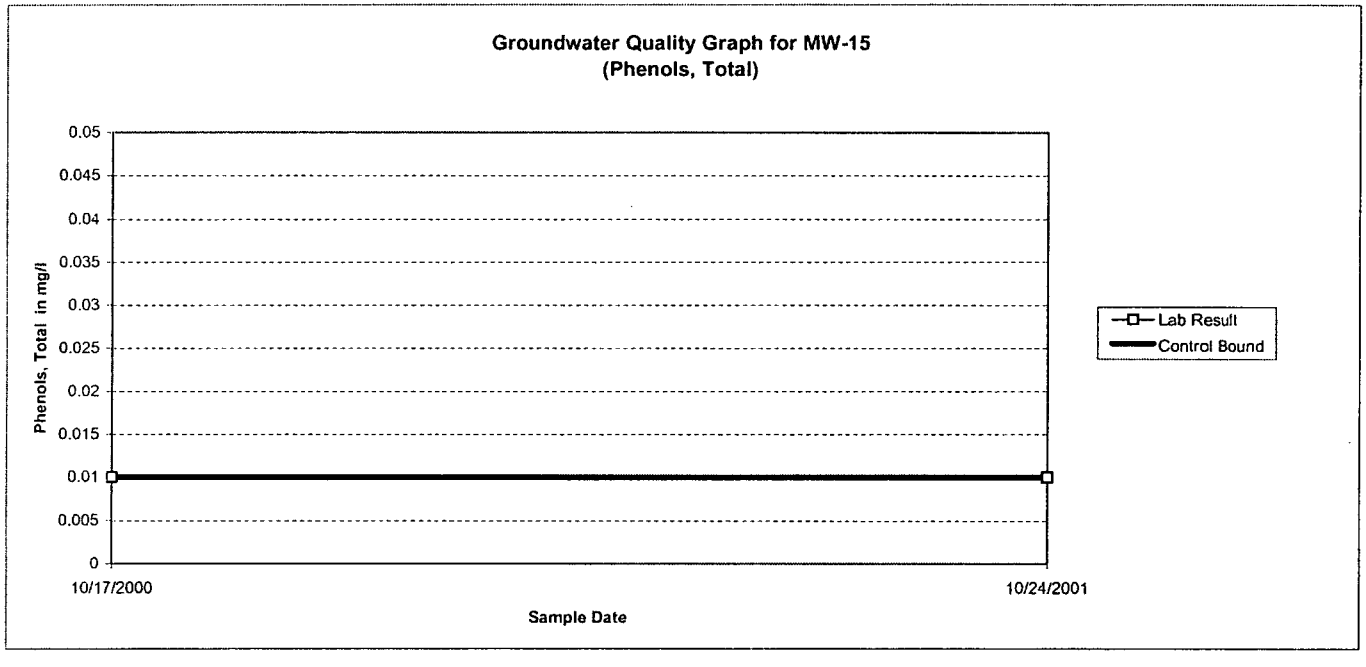


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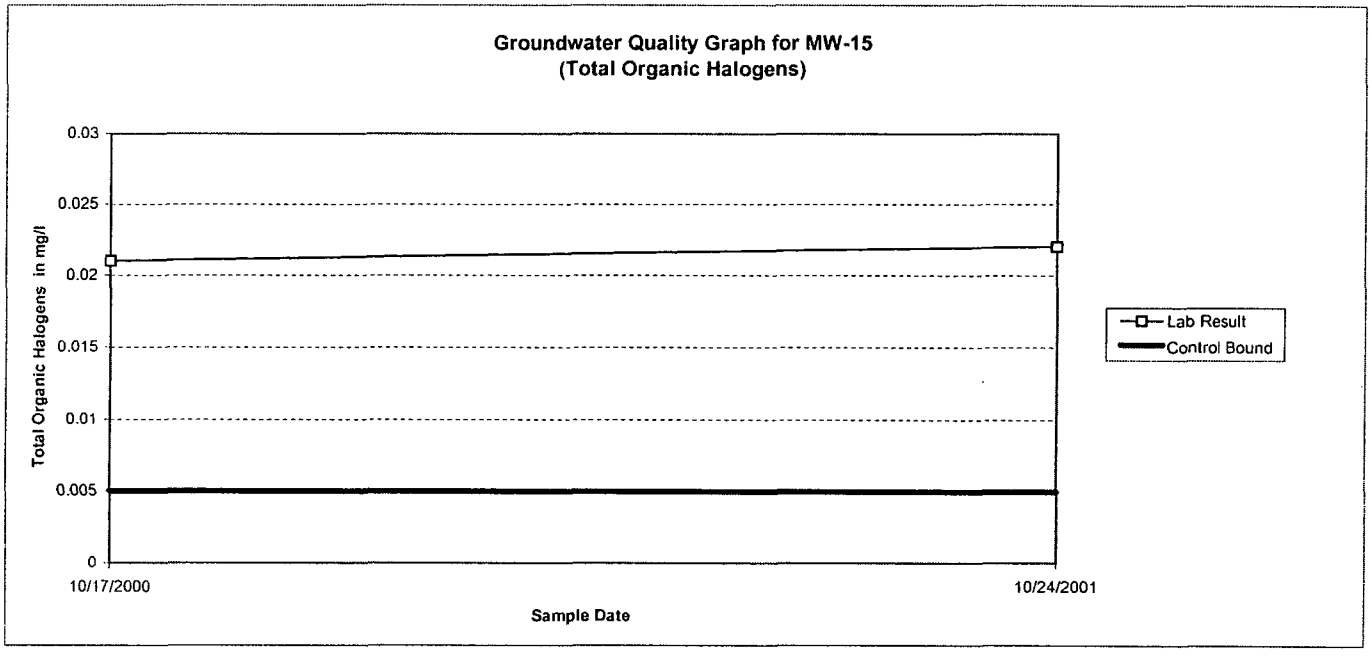


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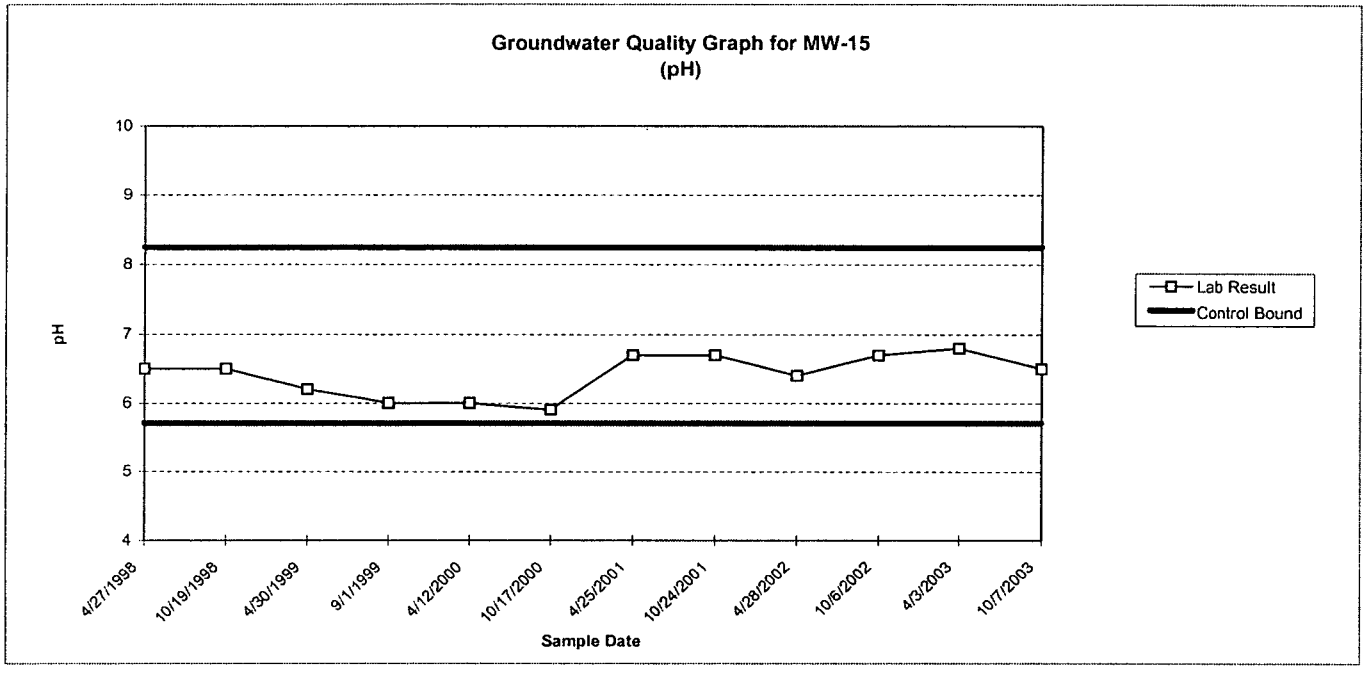


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## ANALYSIS SHEET MW-15

## PLYMOUTH COUNTY LANDFILL
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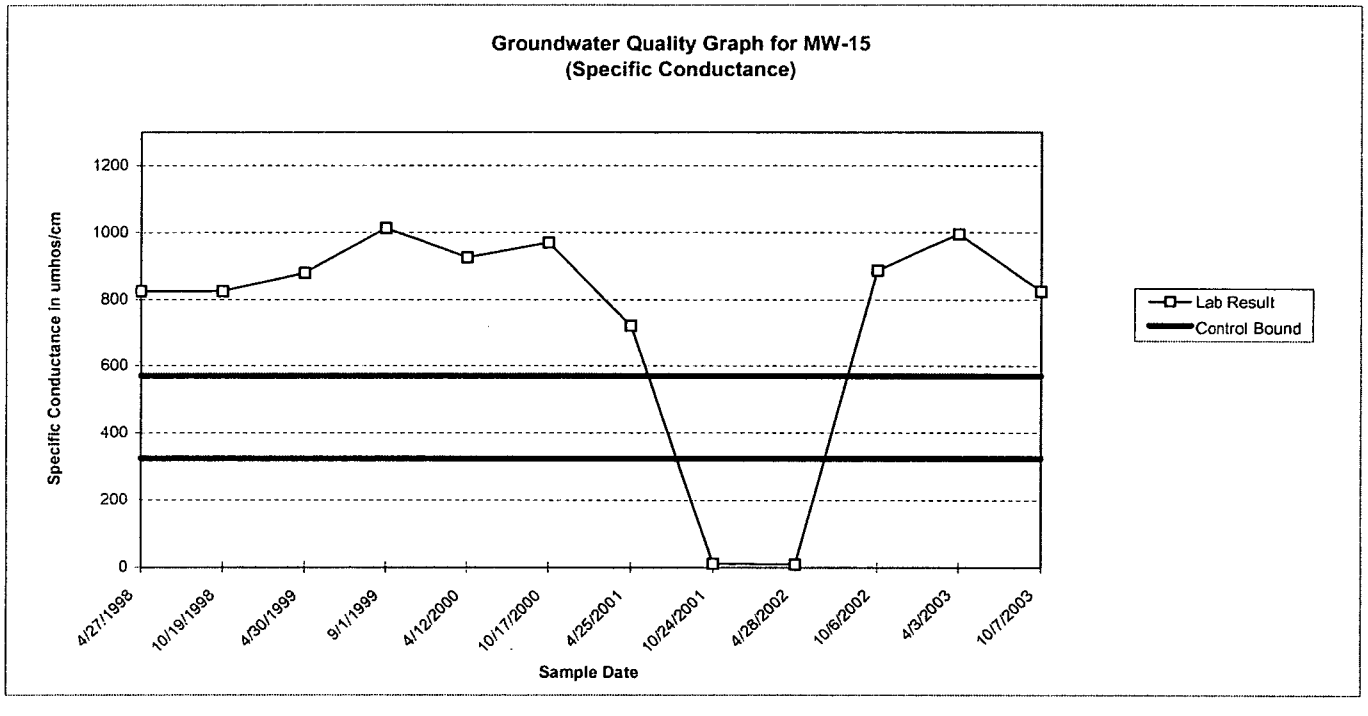


NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-14

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

***SAMPLE LOCATION NO.*** ***MW-14 (Down-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-14 Standard Deviation | MW-14 Mean | 7/12/1996 | 10/10/1996 | 1/21/1997 | 4/17/1997 | 10/4/1997 | 4/22/1998 | 10/19/1998 | 4/30/1999 | 9/1/1999 |
| **Laboratory Parameters** | | | | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 5.159 | 19.253 | 12 | 14 | 13 | 17 | 15 | 18.5 | 19 | 20 | 18 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 5.987 | 5.247 | 24 | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.100 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.022 | 0.055 | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.083 | 0.279 | **0.5** | **0.5** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.236 | 0.332 | **0.5** | **0.2** | **0.2** | **0.2** | 0.41 | **0.2** | 0.54 | 1.1 | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.188 | 0.923 | **0.5** | **0.5** | **1.0** | **1.0** | **1.0** | **1.0** | **1.0** | - | **1.0** |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 1.912 | 2.125 | **0.5** | 4.2 | 3.3 | **0.5** | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.682 | 1.224 | 3.1 | **0.5** | 1.2 | 1.5 | 1.3 | 1.1 | 1.6 | 2.1 | 1.4 |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | - | - | - | - | **0.01** | - | **0.01** | - | **0.01** |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.014 | 0.029 | - | - | - | - | 0.028 | - | **0.005** | - | 0.052 |
| **Field Parameters** | | | | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.4 | 6.6 | 6.6 | 6.7 | 6.5 | 6.3 | 6.5 | 6.5 | 6.4 | 6.1 | 6.1 |
| Specific Conductance (umhos/cm) | 570 | 323 | 139 | 801 | 528 | 690 | 582 | 698 | 682 | 764 | 831 | 913 | 900 |

**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limIt of zero (0) was used for those parameters in which a negative lower control limIt was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-14

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

***SAMPLE LOCATION NO.*** ***MW-14 (Down-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-14 Standard Deviation | MW-14 Mean | 4/12/2000 | 10/17/2000 | 4/25/2001 | 10/23/2001 | 4/28/2002 | 10/6/2002 | 4/3/2003 | 10/7/2003 |
| **Laboratory Parameters** | | | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 5.159 | 19.253 | 17.7 | 17 | 16.8 | 22.6 | 27.9 | 23.1 | 30.9 | 24.8 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 5.987 | 5.247 | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | 15 | 7.7 | 10 |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.100 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.022 | 0.055 | **0.05** | **0.05** | 0.14 | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.083 | 0.279 | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.236 | 0.332 | **0.2** | **0.2** | 0.4 | 0.5 | **0.2** | **0.2** | **0.2** | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.188 | 0.923 | **1.0** | - | - | - | **1.0** | **1.0** | **1.0** | **1.0** |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 1.912 | 2.125 | - | - | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.682 | 1.224 | 1.7 | **0.5** | 1.1 | 1.1 | 1.1 | **0.5** | **0.5** | **0.5** |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | - | **0.01** | - | **0.01** | **0.01** | **0.01** | - | **0.01** |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.014 | 0.029 | - | 0.022 | - | 0.041 | 0.038 | 0.025 | - | 0.023 |
| **Field Parameters** | | | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.4 | 6.6 | 6.0 | 6.3 | 7.0 | 6.8 | 6.5 | 7 | 7 | 7.2 |
| Specific Conductance (umhos/cm) | 570 | 323 | 139 | 801 | 914 | 808 | 941 | 889 | 742 | 757 | 930 | 1050 |

**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
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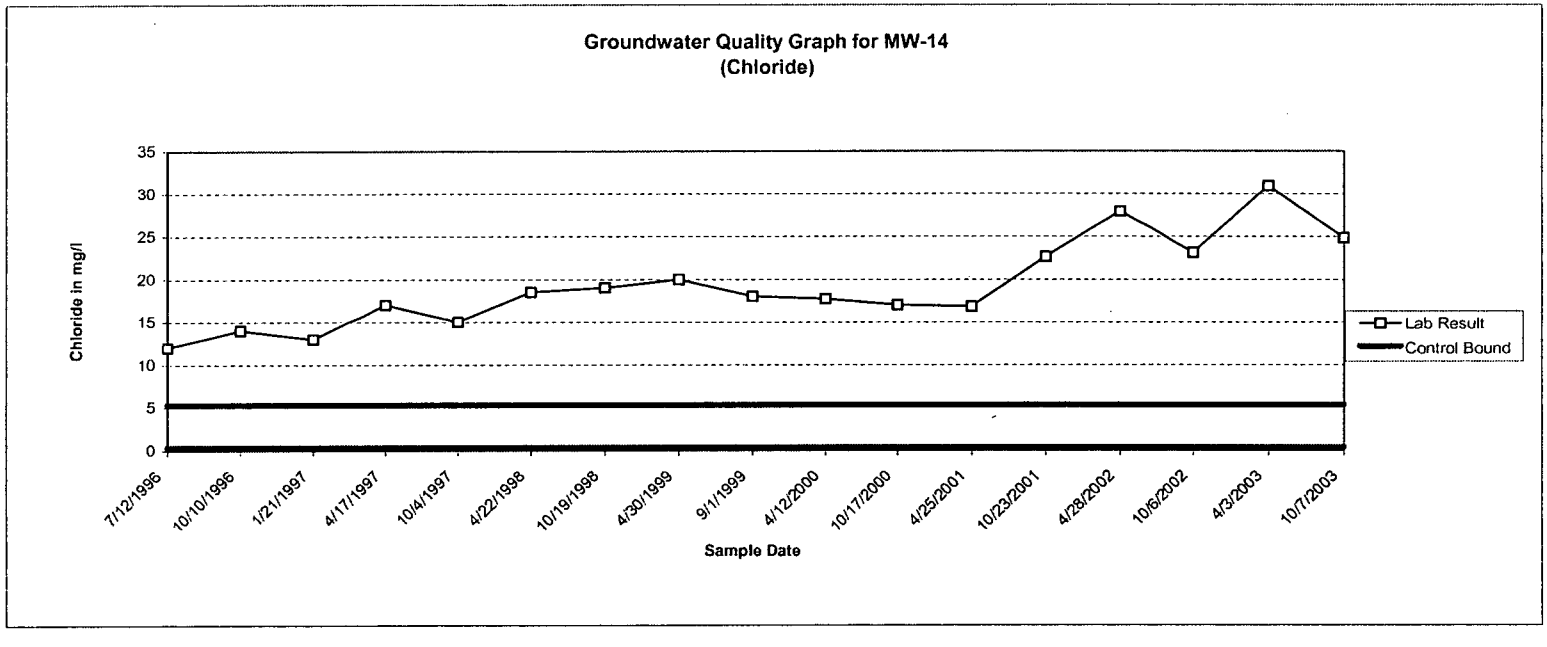
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

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**ANALYSIS SHEET MW-14**

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**GROUNDWATER SAMPLING AND ANALYSIS**
**TERRACON PROJECT NO. 40905033**

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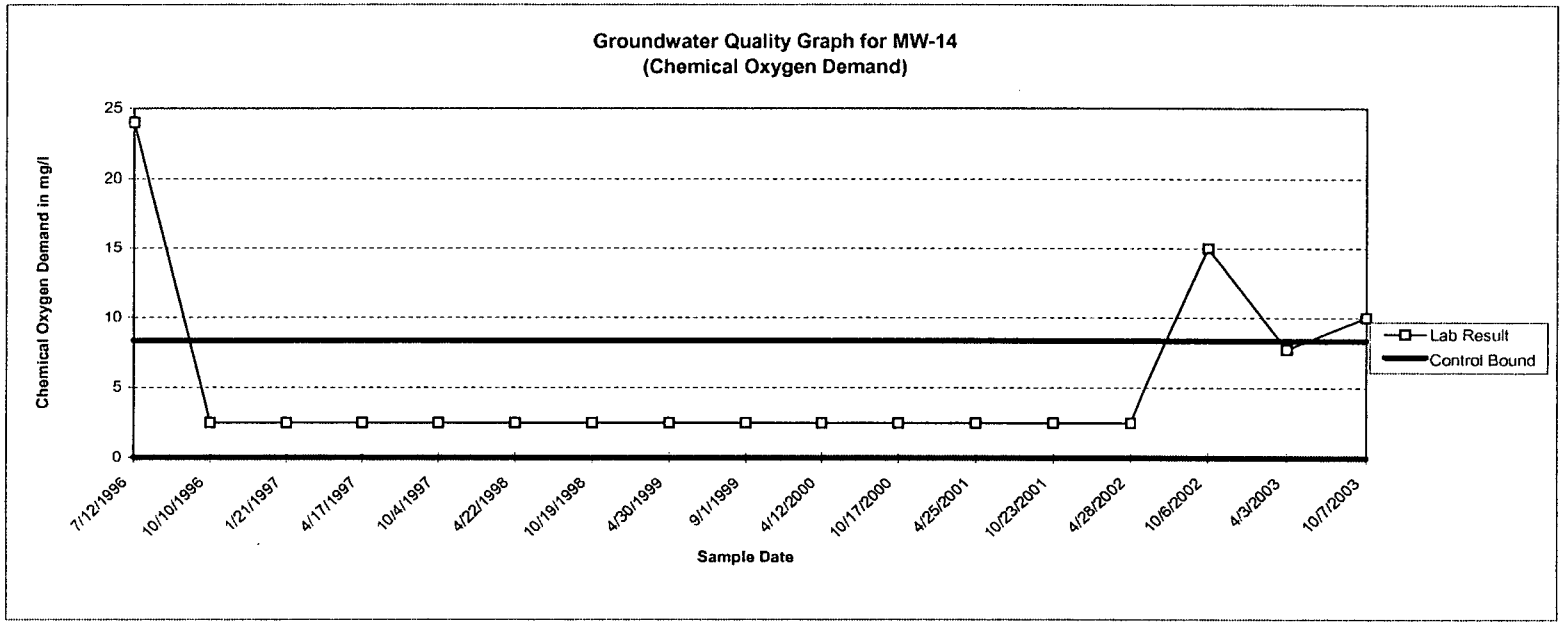


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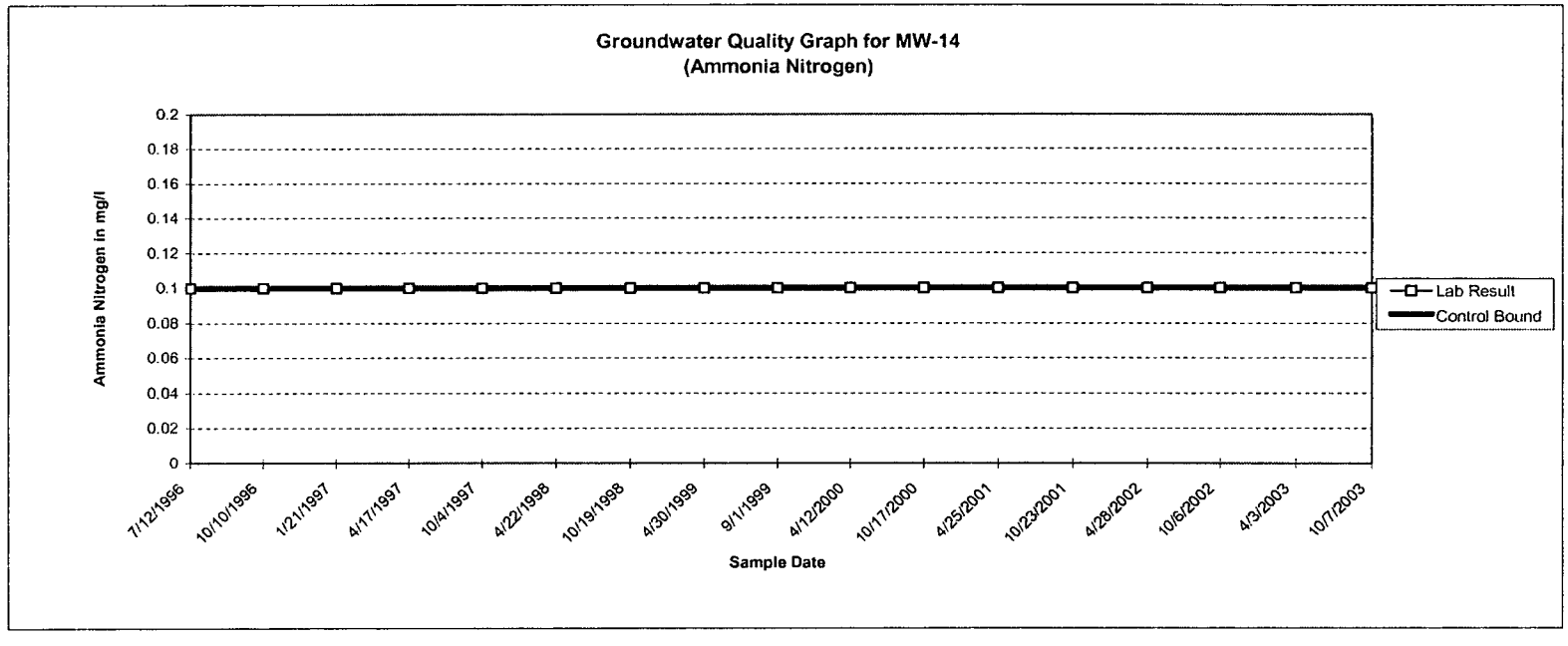


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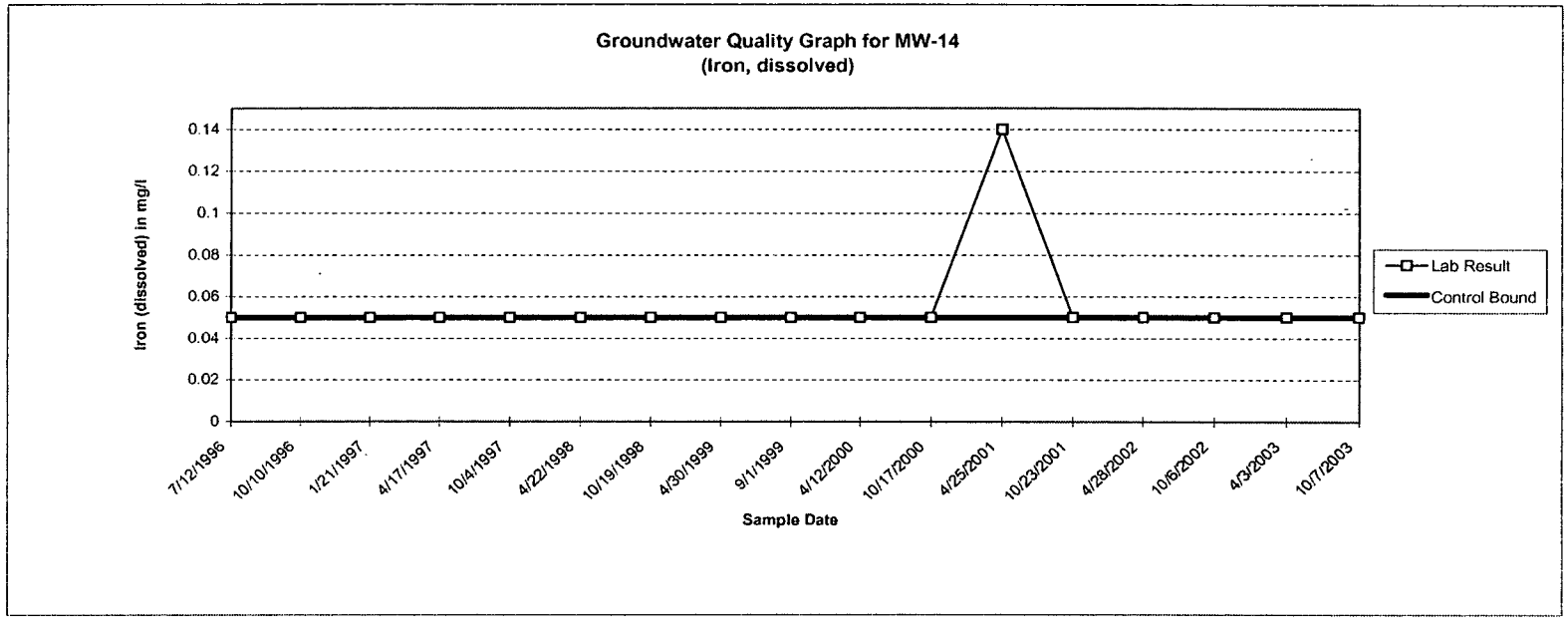


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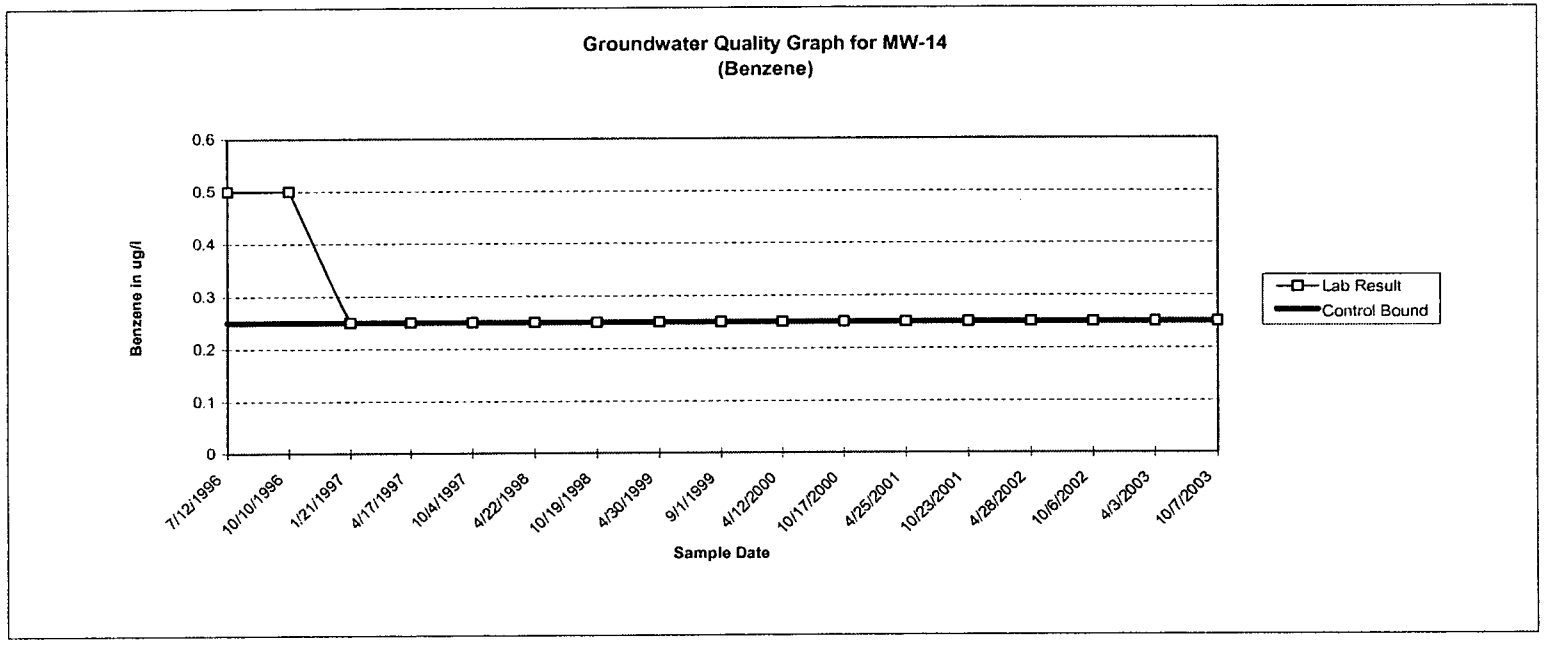


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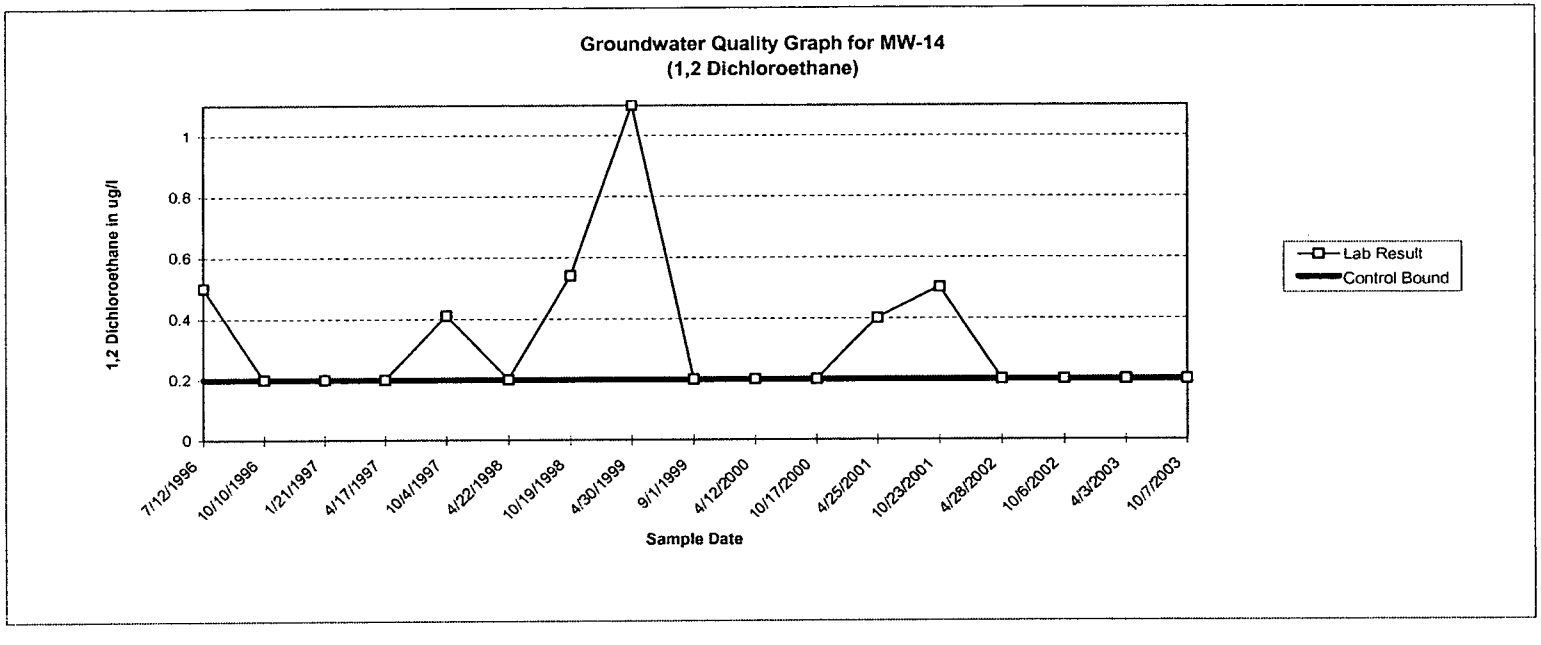


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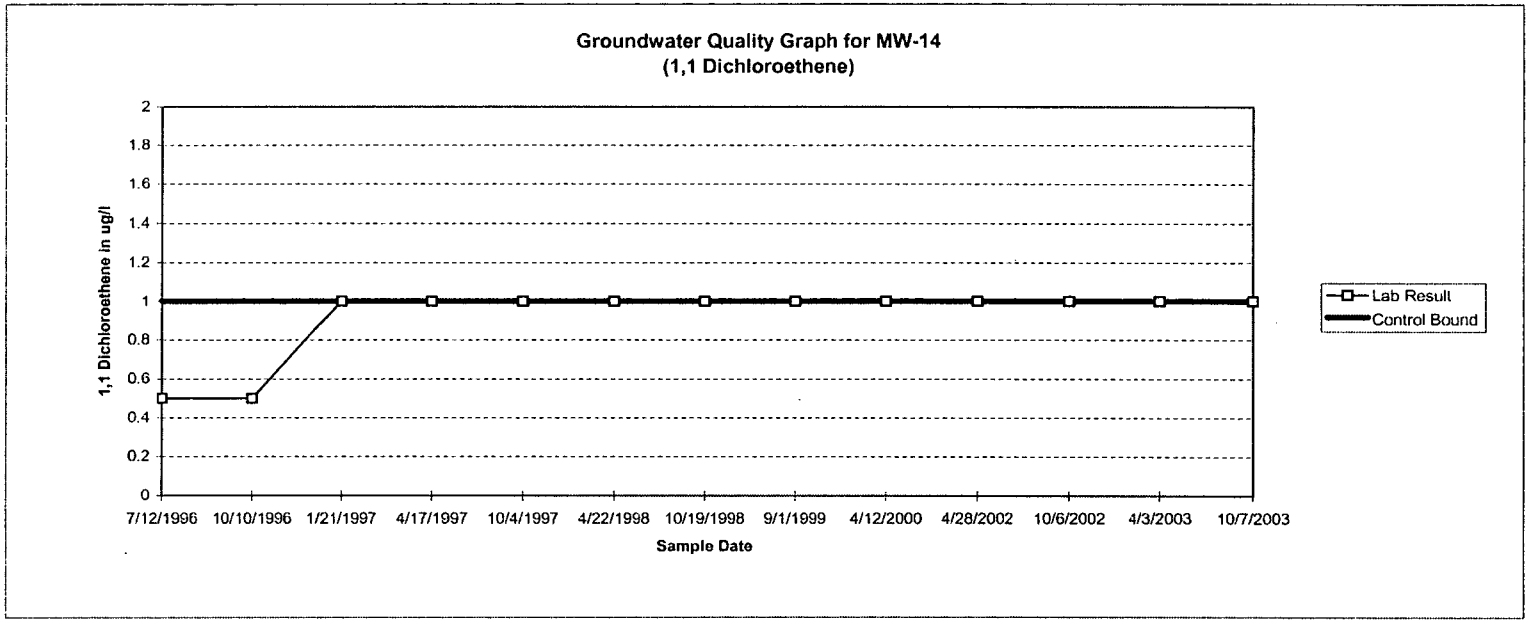


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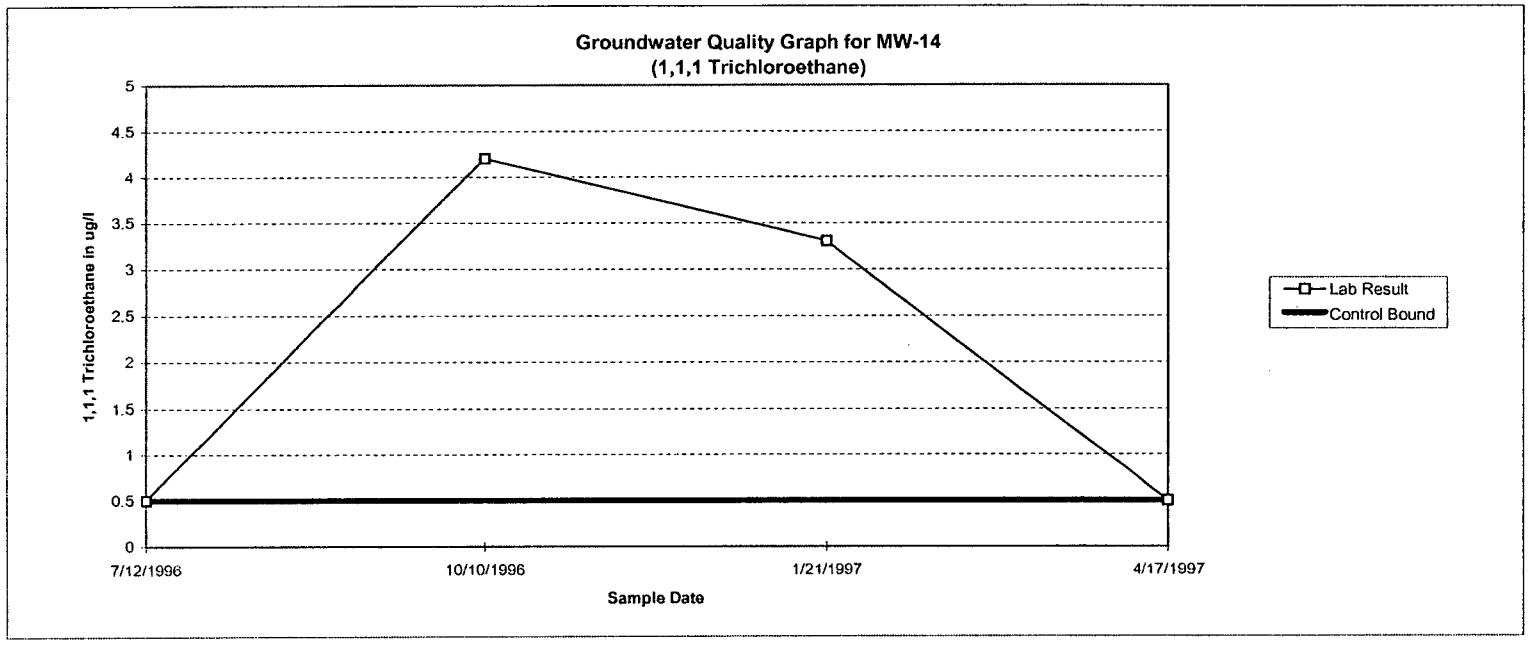


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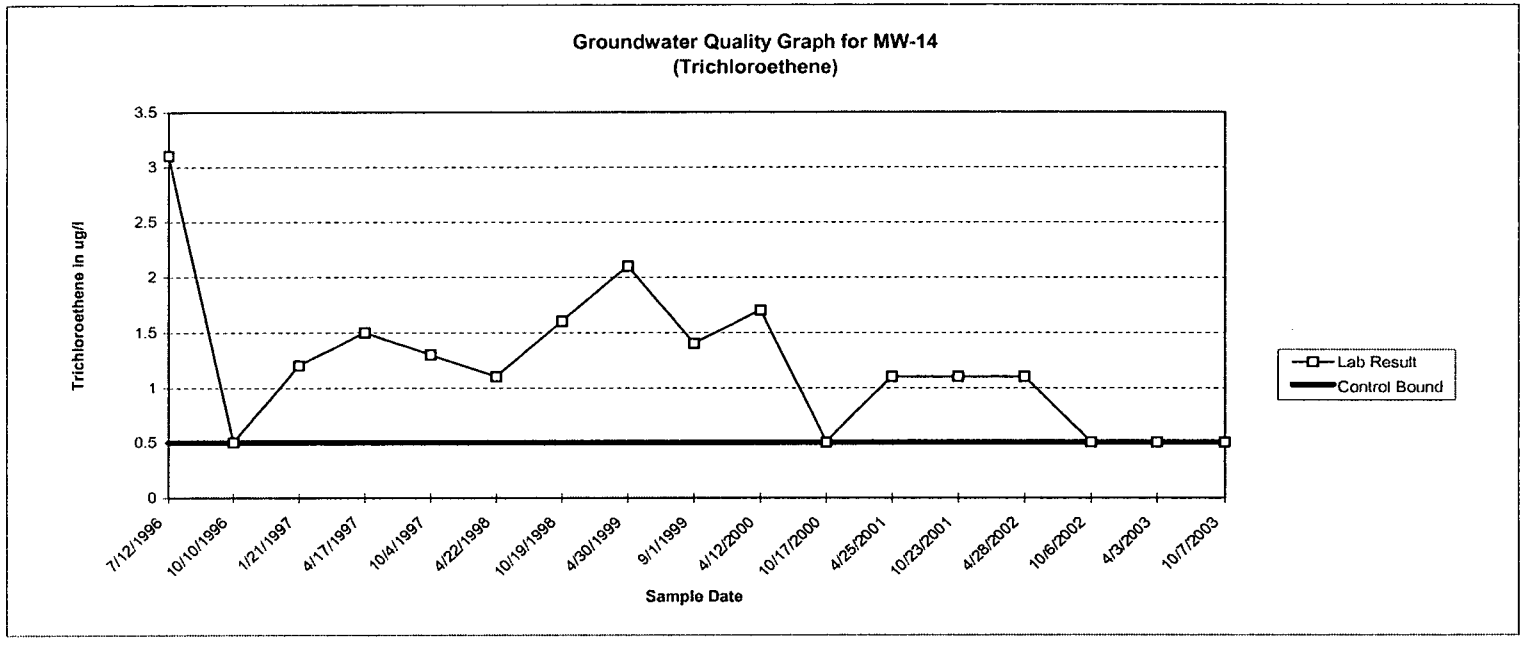


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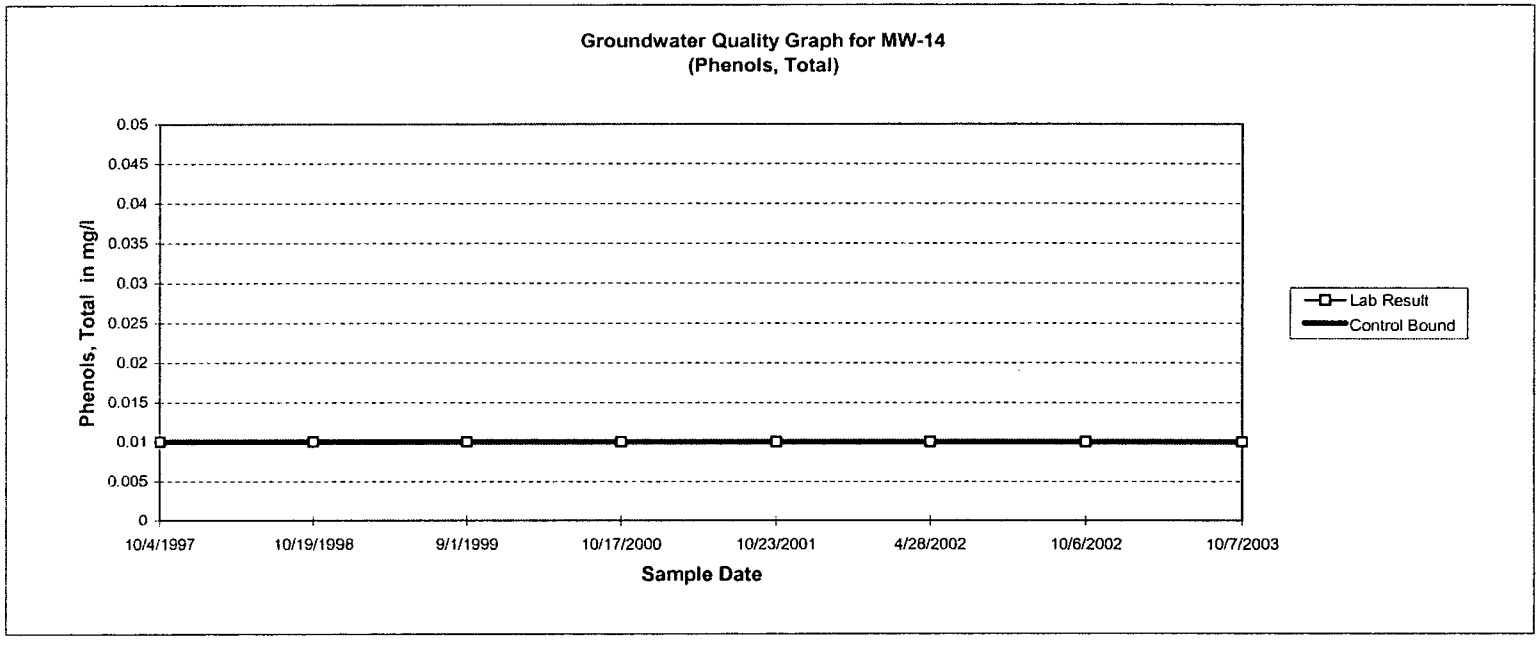


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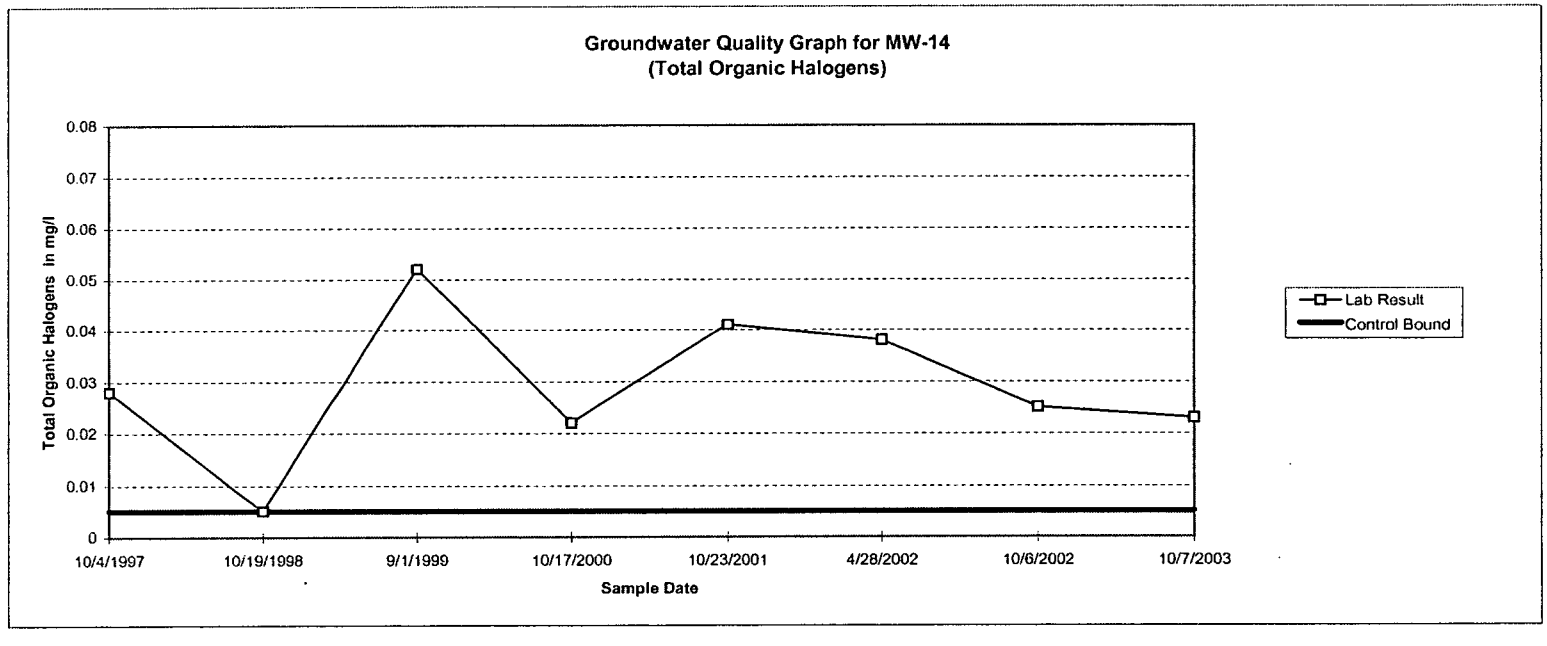


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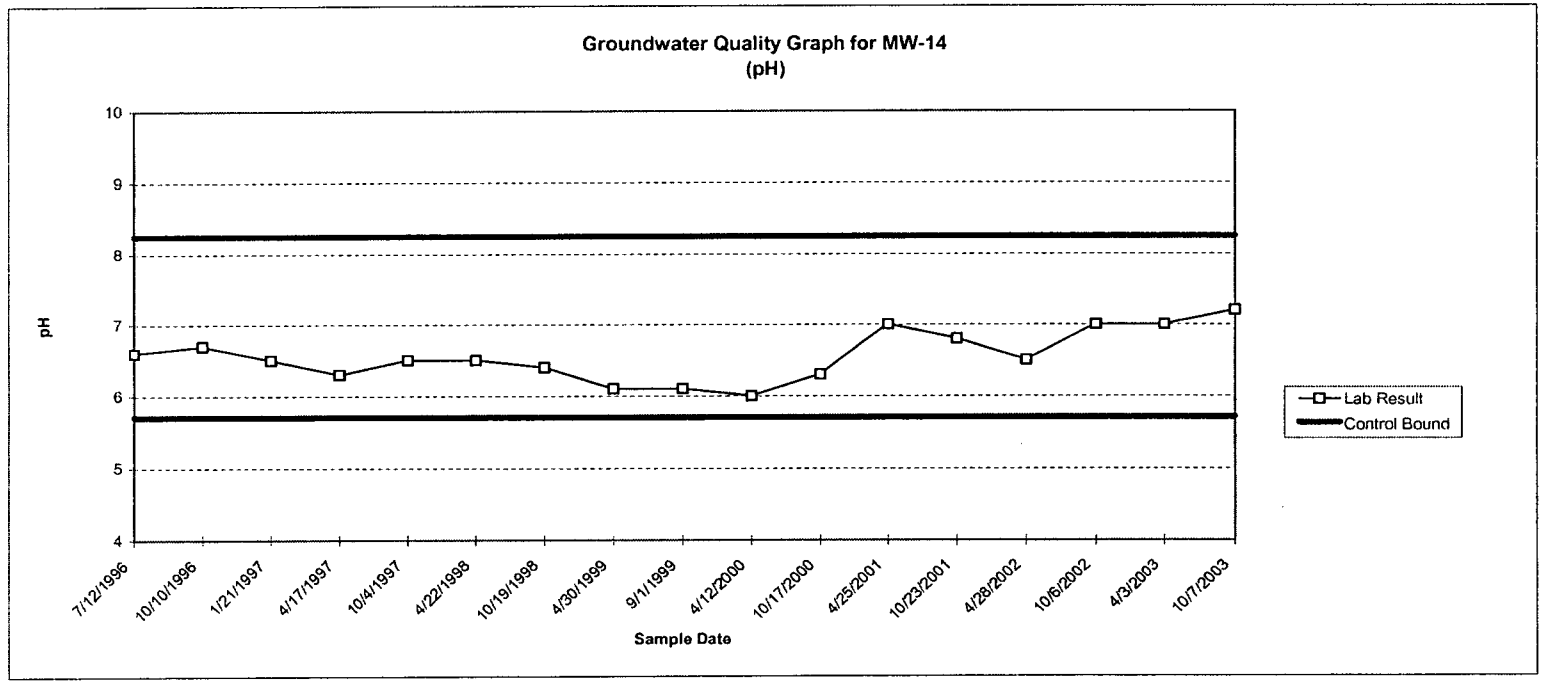
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

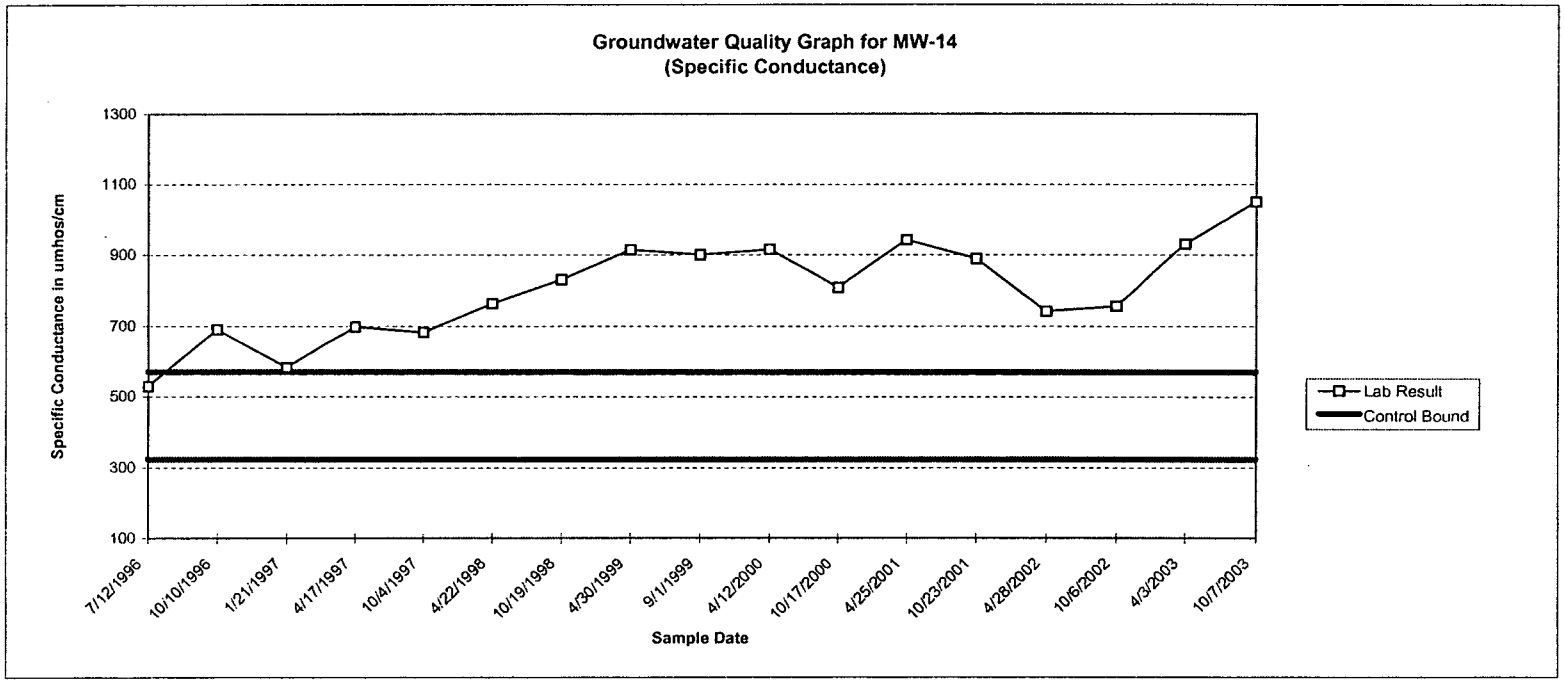



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

**ANALYSIS SHEET MW-14**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**TERRACON PROJECT NO. 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

*SAMPLE LOCATION NO.* *MW-13* *(Down-gradient)*

*ANALYSIS PERFORMED BY:* *TestAmerica Laboratories* *SAMPLED BY:* *Plymouth County Landfill Personnel*

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-13 Standard Deviation | MW-13 Mean | 7/12/1996 | 10/11/1996 | 1/21/1997 | 4/17/1997 | 10/4/1997 | 4/22/1998 | 10/19/1998 | 4/30/1999 | 9/3/1999 | 4/12/2000 | 10/17/2000 |
| **Laboratory Parameters** | | | | | | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 2.923 | 17.082 | 12 | 13 | 14 | 18 | 18 | 15.6 | 18 | 17 | 18 | 17.5 | 19.9 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 14.830 | 8.847 | 63 | **2.5** | 7.5 | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | 22 | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.024 | 0.106 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | 0.2 | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 1.088 | 0.780 | 0.9 | 3.4 | 3.6 | **0.05** | 0.49 | 0.20 | 0.05 | 0.05 | 0.72 | 1.05 | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.110 | 0.306 | **0.5** | **0.5** | **0.25** | **0.25** | - | - | - | - | - | - | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.100 | 0.233 | **0.5** | **0.2** | **0.2** | **0.2** | - | - | - | - | - | - | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.258 | 0.833 | **0.5** | **0.5** | **1.0** | **1.0** | - | - | - | - | - | - | - |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.000 | 0.500 | **0.5** | **0.5** | **0.5** | **0.5** | - | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.000 | 0.500 | **0.5** | **0.5** | **0.5** | **0.5** | - | - | - | - | - | - | **0.5** |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | - | - | - | - | **0.01** | - | **0.01** | - | **0.01** | - | **0.01** |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.047 | 0.024 | - | - | - | - | **0.005** | - | **0.005** | - | 0.138 | - | **0.005** |
| **Field Parameters** | | | | | | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.4 | 6.7 | 6.5 | 6.8 | 6.8 | 6.6 | 6.4 | 6.5 | 6.6 | 6.4 | 6.1 | 6.2 | 5.8 |
| Specific Conductance (umhos/cm) | 570 | 323 | 120 | 561 | 390 | 475 | 479 | 645 | 548 | 584 | 525 | 605 | 558 | 517 | 536 |

**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

*SAMPLE LOCATION NO.* ***MW-13*** ***(Down-gradient)***

*ANALYSIS PERFORMED BY:* ***TestAmerica Laboratories*** *SAMPLED BY:* ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-13 Standard Deviation | MW-13 Mean | 4/25/2001 | 10/23/2001 | 4/28/2002 | 10/6/2002 | 4/3/2003 | 10/7/2003 |
| **Laboratory Parameters** | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 2.923 | 17.082 | 15.1 | 16.7 | 16.6 | 16.5 | 24.8 | 19.7 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 14.830 | 8.847 | 6.3 | **2.5** | 8.2 | 8.4 | 10 | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.024 | 0.106 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 1.088 | 0.780 | 0.16 | **0.05** | 0.71 | 0.85 | **0.05** | 0.88 |
| Benzene (µg/l) | 0.250 | 0.250 | 0.110 | 0.306 | **0.25** | **0.25** | - | - | **0.25** | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.100 | 0.233 | **0.2** | **0.2** | - | - | **0.2** | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.258 | 0.833 | - | - | - | - | **1.0** | **1.0** |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.000 | 0.500 | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.000 | 0.500 | **0.5** | **0.5** | - | - | **0.5** | **0.5** |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | - | **0.01** | **0.01** | **0.01** | **0.01** | - |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.047 | 0.024 | - | **0.005** | **0.005** | **0.005** | 0.023 | - |
| **Field Parameters** | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.4 | 6.7 | 6.8 | 7.1 | 6.7 | 7.3 | 7.0 | 7.5 |
| Specific Conductance (umhos/cm) | 570 | 323 | 120 | 561 | 648 | 530 | 423 | 499 | 930 | 646 |

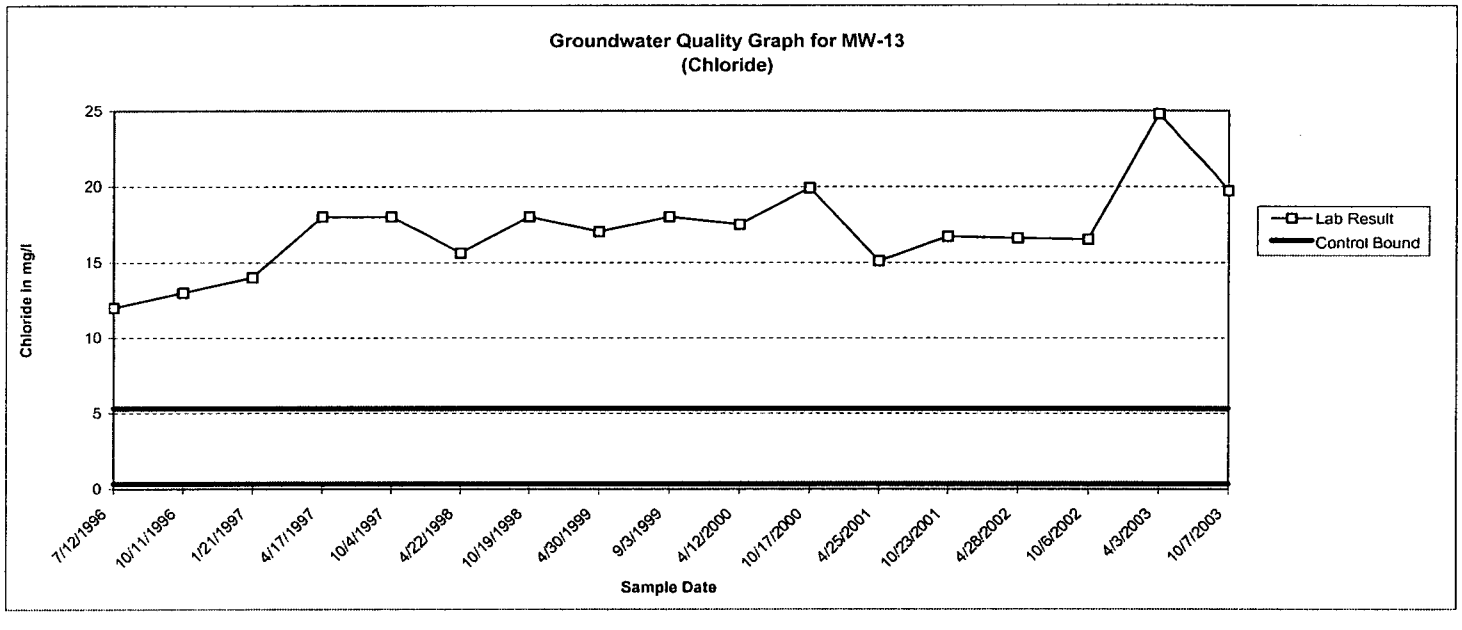
**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

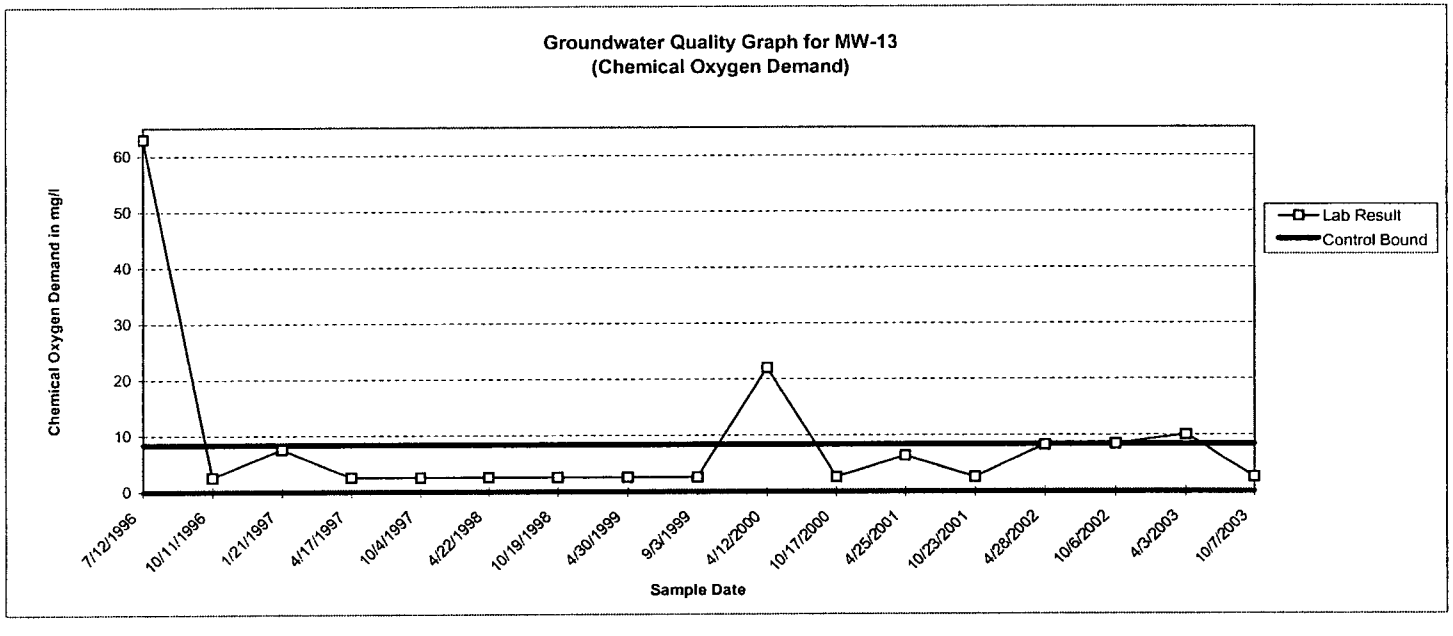



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

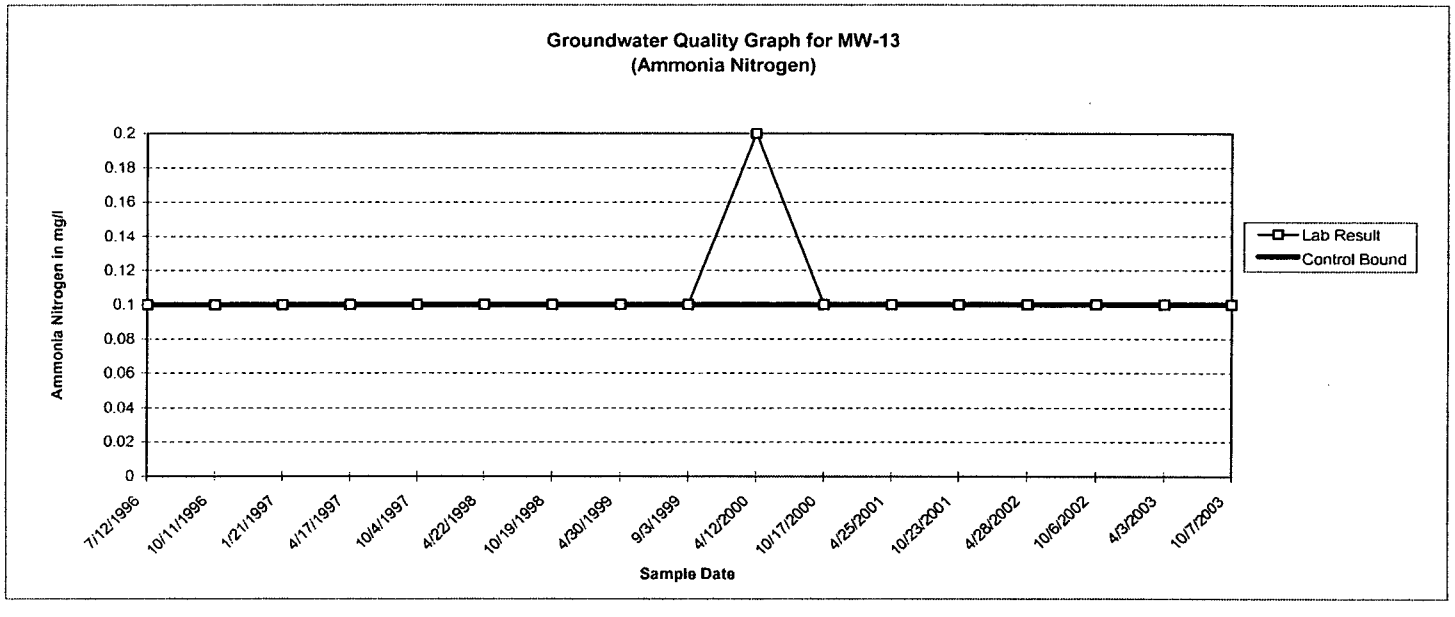



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

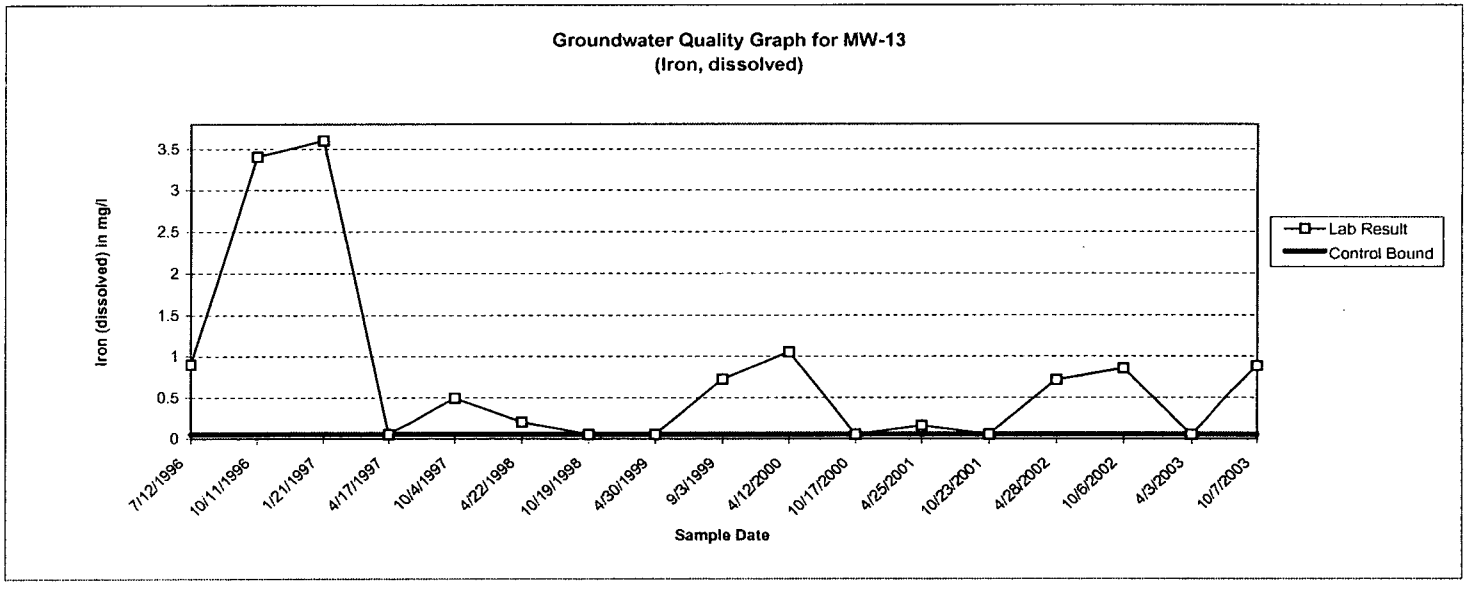



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

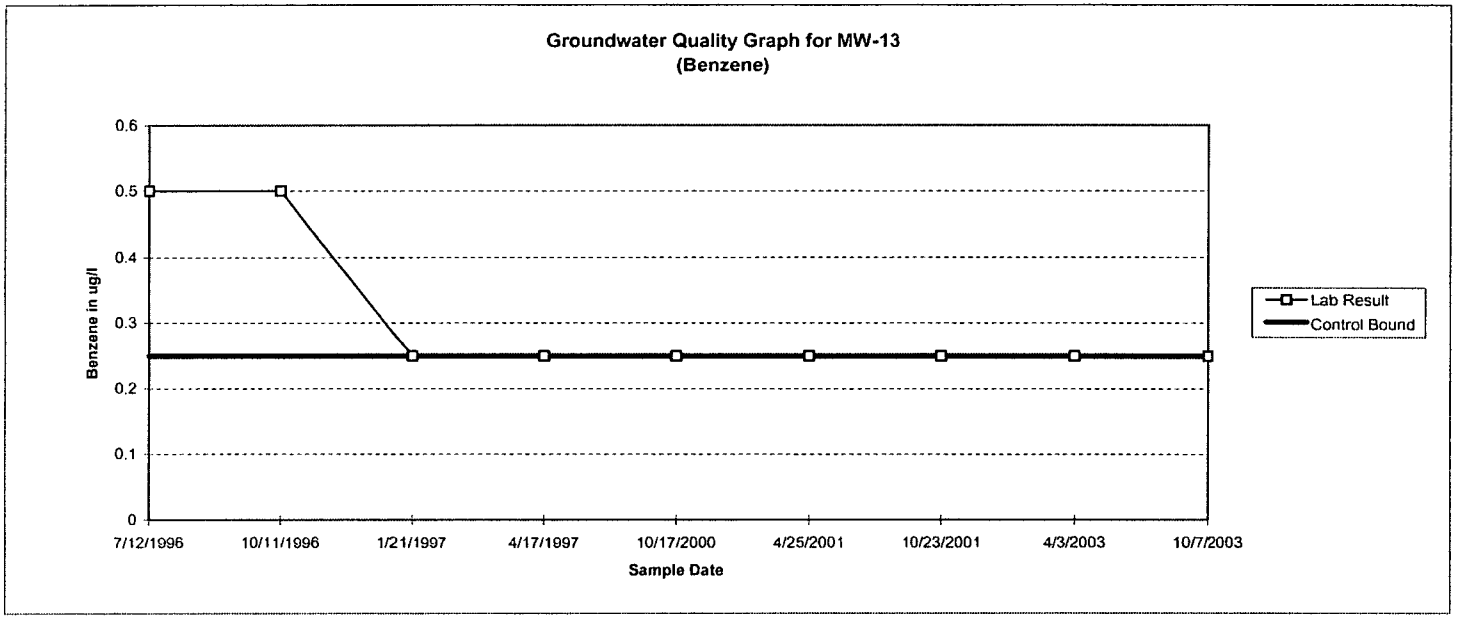



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
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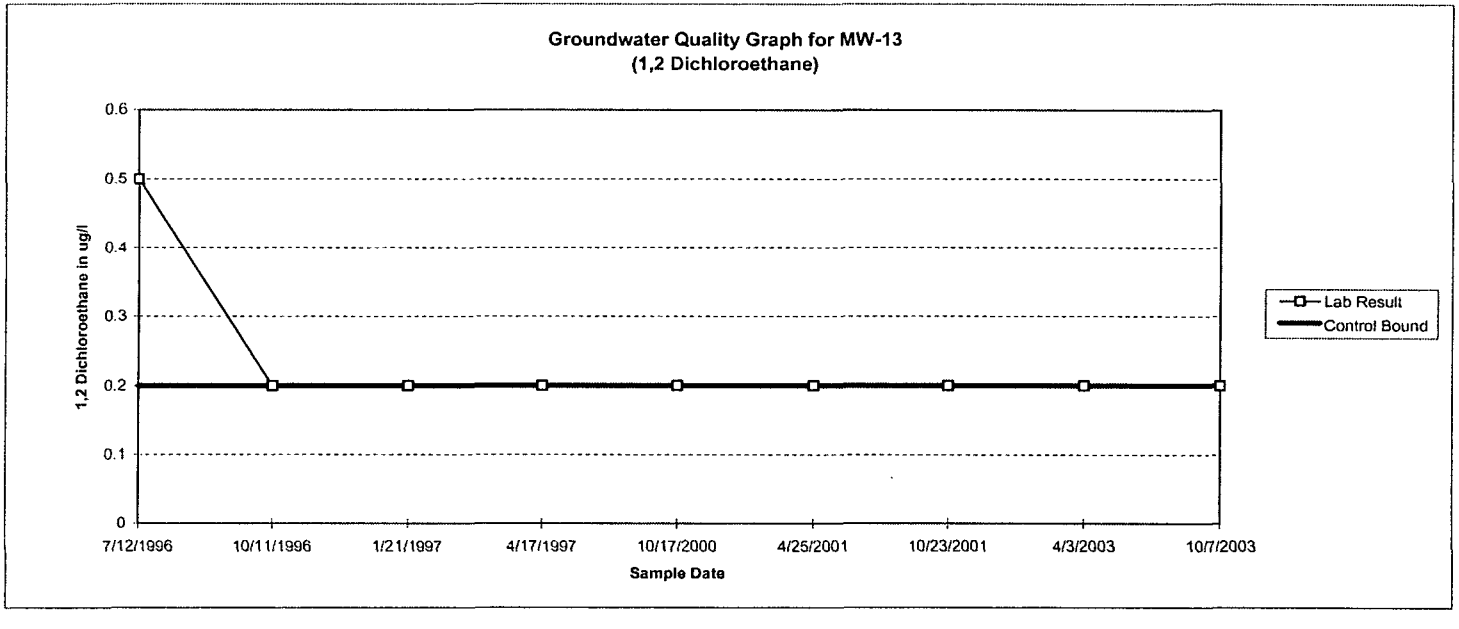
## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

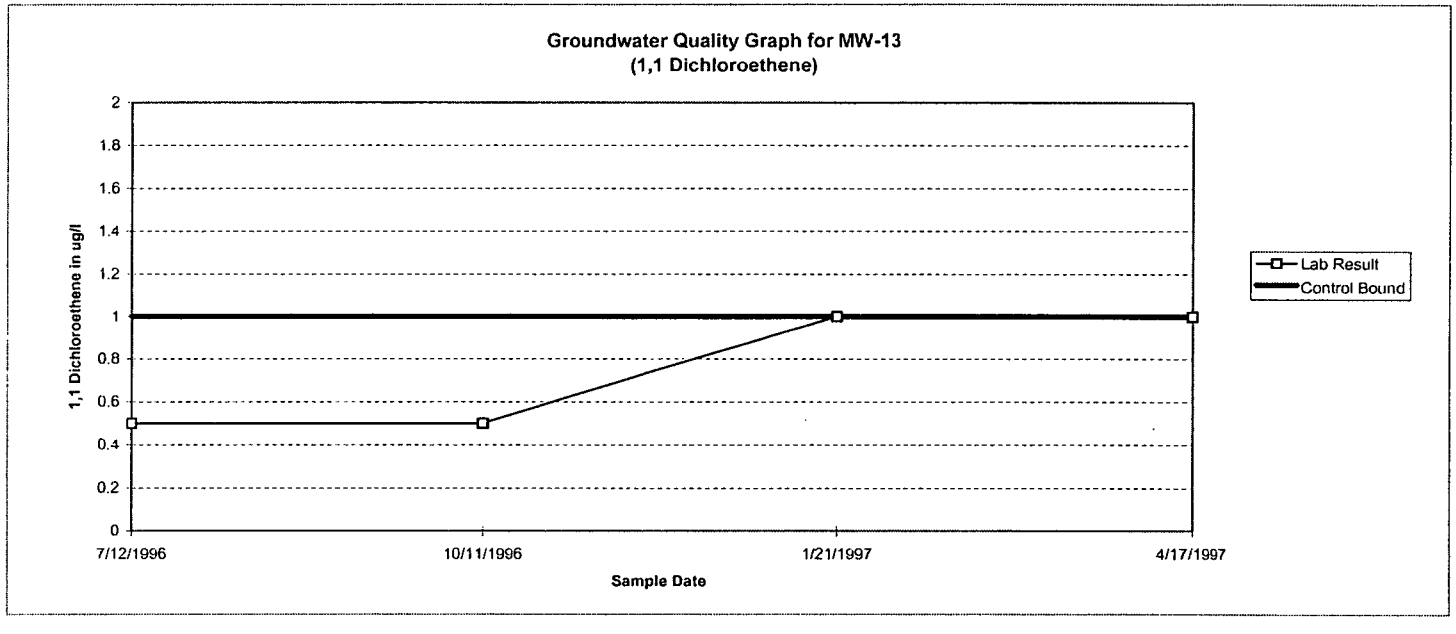



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

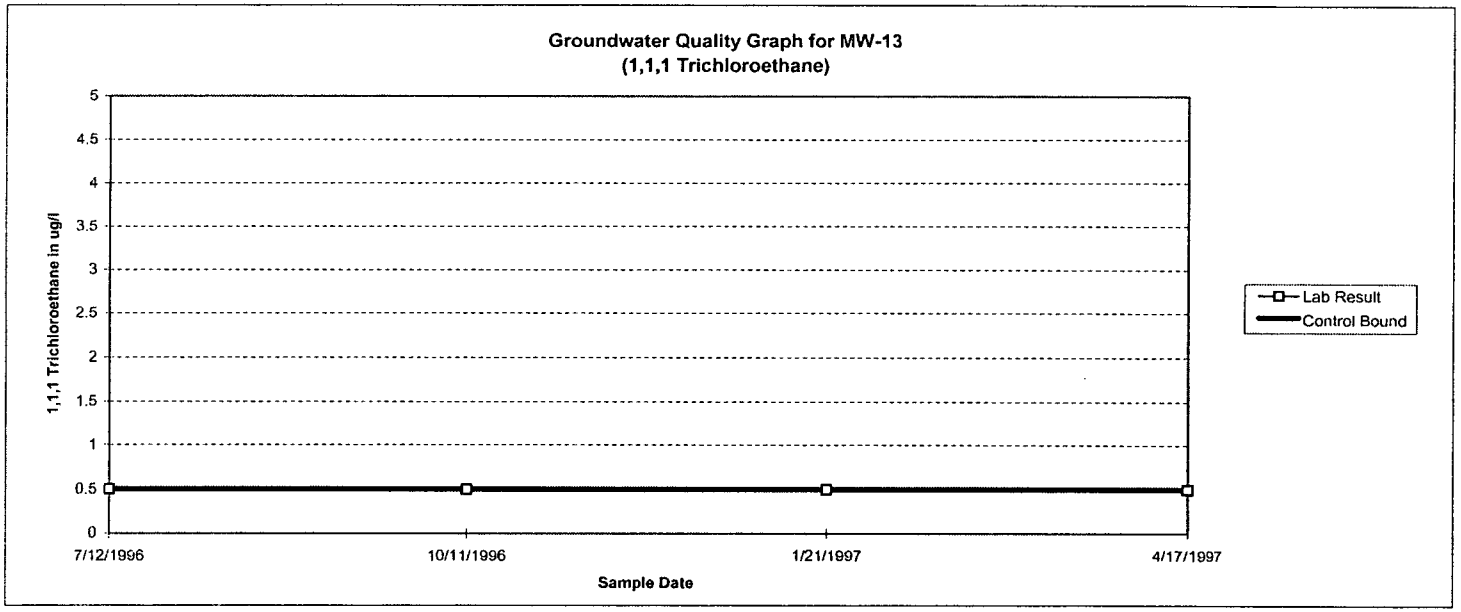



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

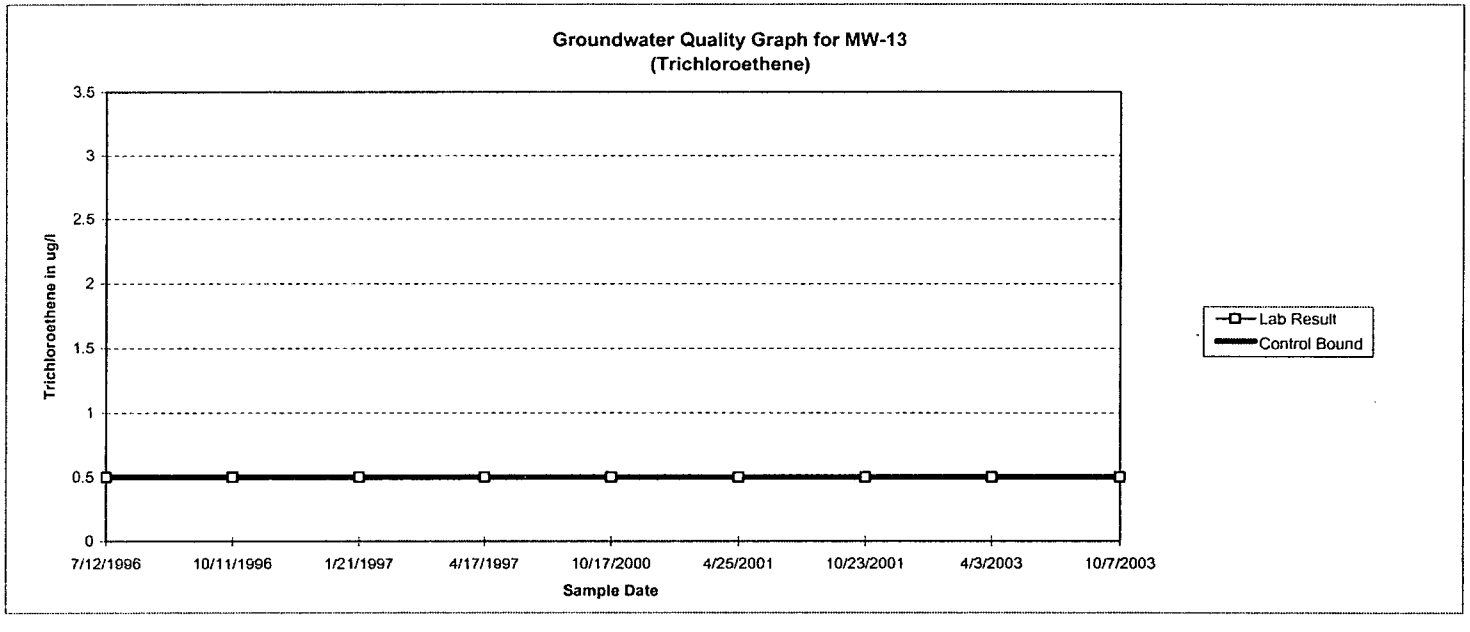



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

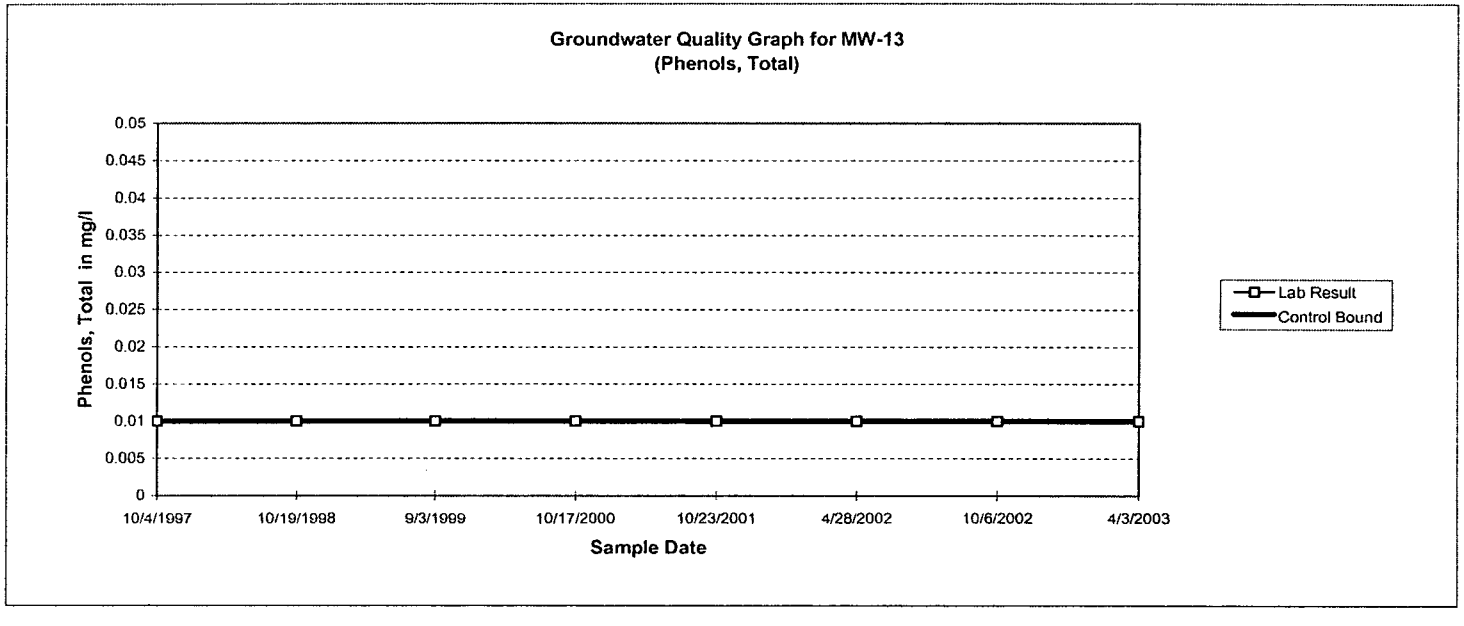



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

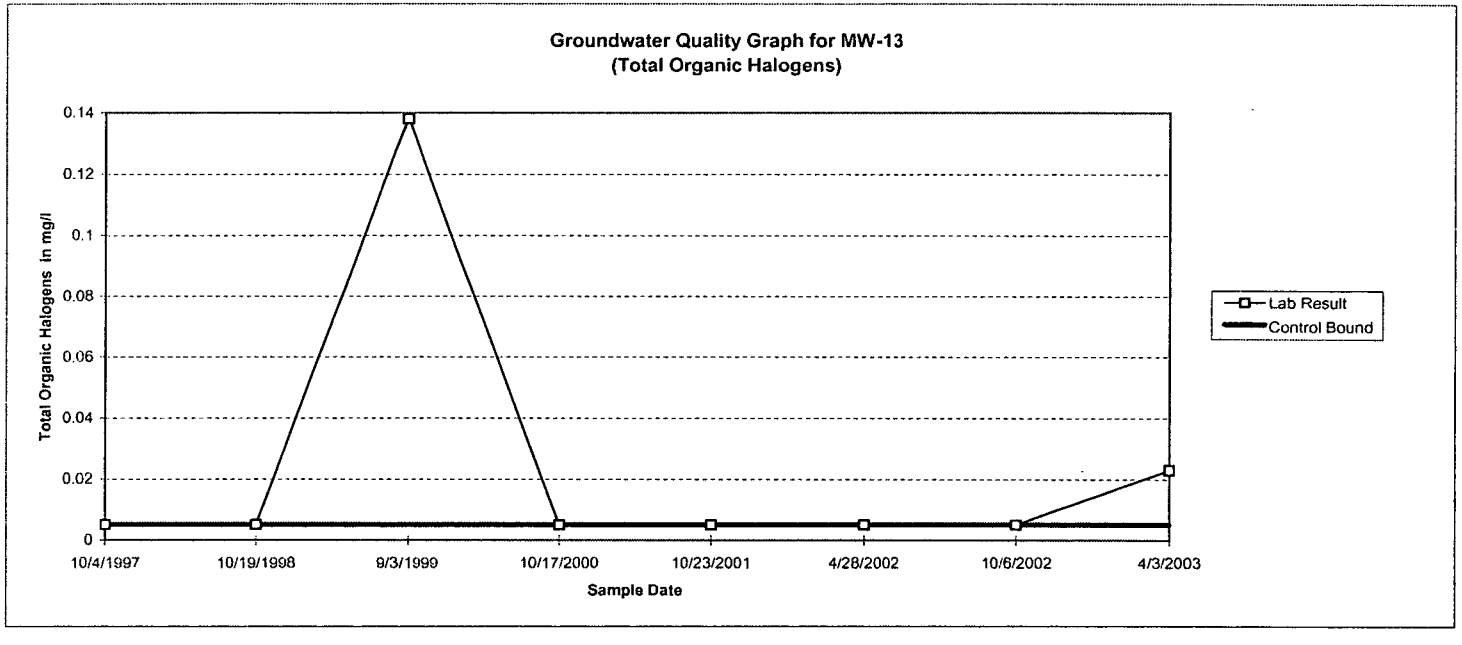



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

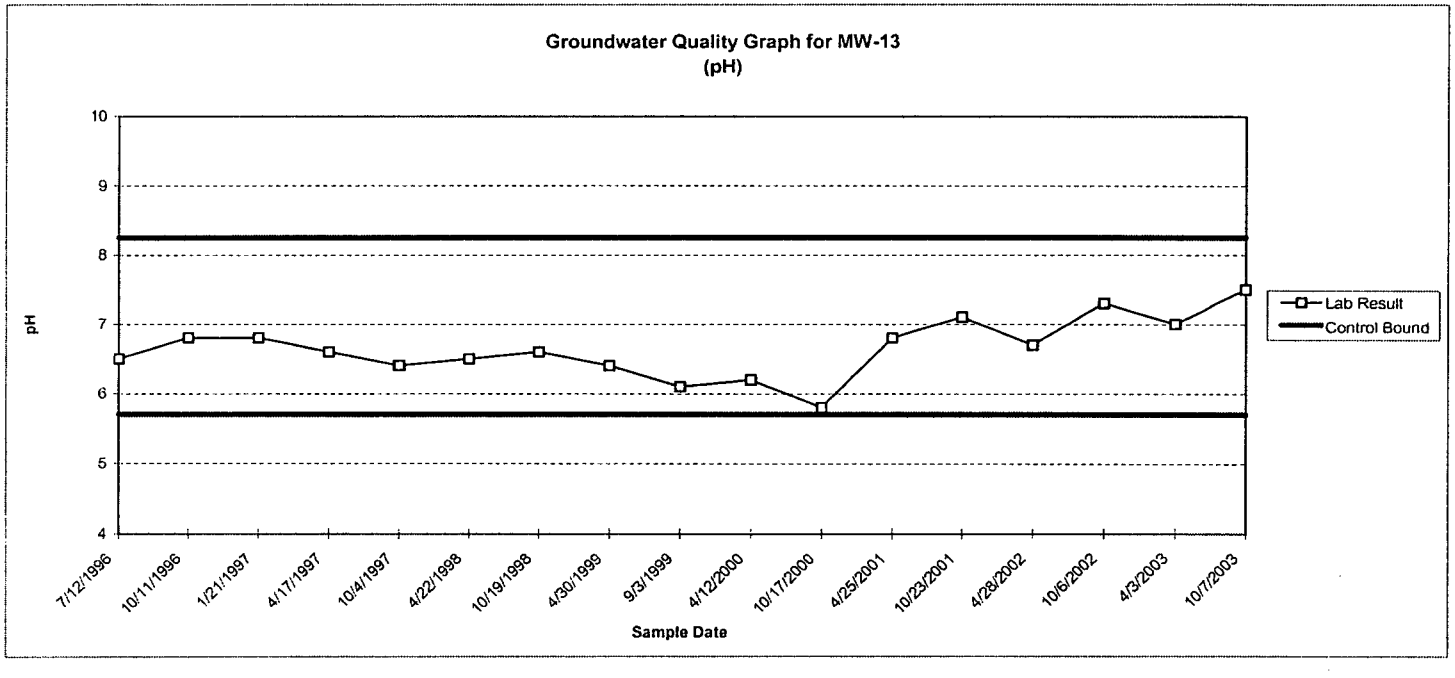



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

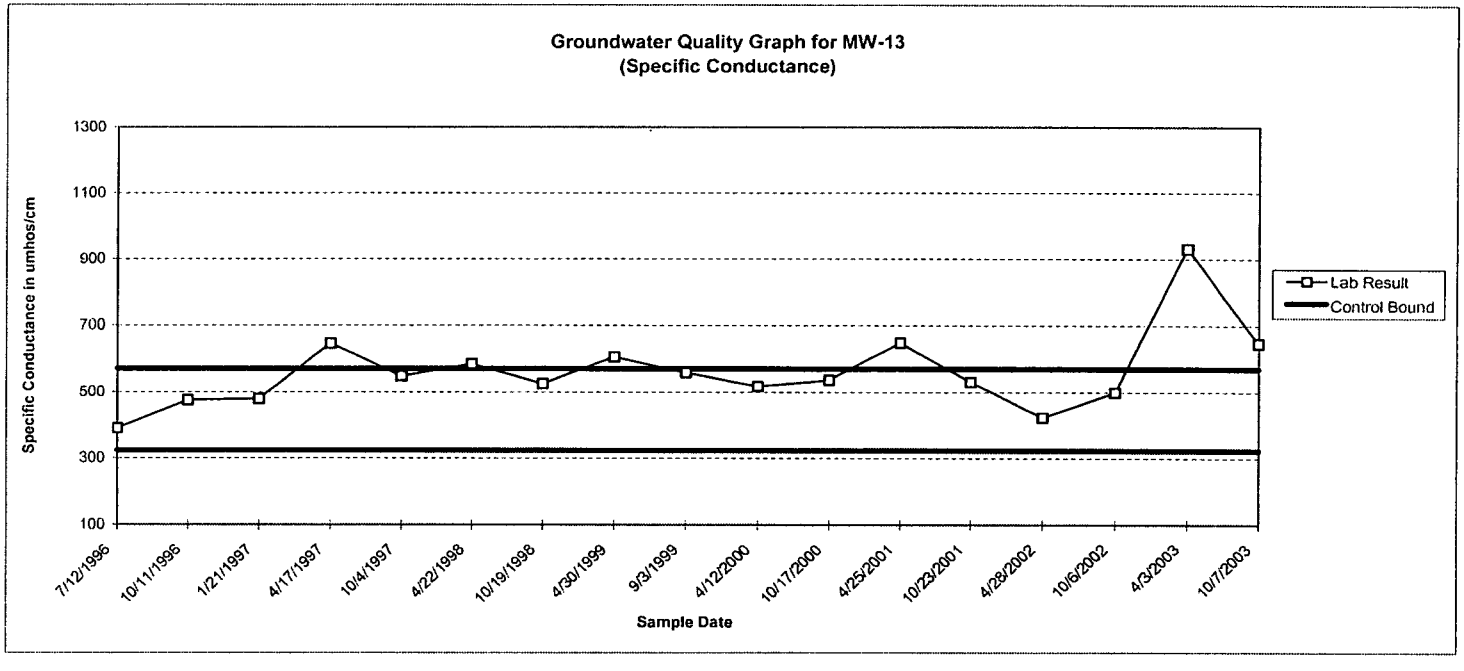



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-13

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-12

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

***SAMPLE LOCATION NO.*** ***MW-12 (Down-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-12 Standard Deviation | MW-12 Mean | 10/10/1996 | 1/21/1997 | 4/17/1997 | 7/15/1997 | 10/4/1997 | 4/22/1998 | 10/19/1998 | 4/30/1999 | 9/3/1999 | 4/12/2000 | 10/17/2000 |
| **Laboratory Parameters** | | | | | | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 19.371 | 16.071 | 5.4 | 6.4 | 7.5 | 6.8 | 6.6 | 8.1 | 7.4 | 9.6 | 8.3 | 6.4 | 7.9 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 5.464 | 5.382 | 7.0 | 11 | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.027 | 0.106 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | 0.21 | **0.1** | **0.1** | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.000 | 0.050 | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.865 | 2.817 | **0.5** | 2.1 | 2.2 | 2.1 | 2.4 | 2.7 | 3.1 | 3.3 | 3.0 | 3 | 3.5 |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.000 | 0.200 | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.144 | 0.958 | **0.5** | **1.0** | **1.0** | **1.0** | **1.0** | **1.0** | **1.0** | - | **1.0** | **1.0** | - |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.727 | 1.575 | 1.8 | 2.1 | **0.5** | 1.9 | - | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.720 | 4.880 | 2.8 | 5.5 | 4.9 | 4.7 | 4.7 | 4.8 | 5.4 | 5.6 | 4.8 | 5.3 | 5.4 |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | - | - | - | - | **0.01** | - | **0.01** | - | **0.01** | - | **0.01** |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.017 | 0.055 | - | - | - | - | 0.083 | - | 0.023 | - | 0.064 | - | 0.055 |
| **Field Parameters** | | | | | | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.5 | 6.2 | 6.4 | 6.2 | 6.2 | 6.1 | 5.0 | 6.0 | 6 | 6 | 5.8 | 5.7 | 5.8 |
| Specific Conductance (umhos/cm) | 570 | 323 | 142 | 1055 | 1026 | 922 | 1010 | 1017 | 906 | 1044 | 1046 | 1102 | 1171 | 1087 | 1129 |

NOTE:

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-12

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

***SAMPLE LOCATION NO.*** ***MW-12 (Down-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-12 Standard Deviation | MW-12 Mean | 4/25/2001 | 10/23/2001 | 4/28/2002 | 10/6/2002 | 4/3/2003 | 10/7/2003 |
| **Laboratory Parameters** | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 19.371 | 16.071 | 8.0 | 16.2 | 17.4 | 27 | 43.1 | 81.1 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 5.464 | 5.382 | **2.5** | **2.5** | 8.5 | 22 | 13 | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.027 | 0.106 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.000 | 0.050 | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.865 | 2.817 | 2.8 | 4.3 | 3.6 | 3.59 | - | 2.88 |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.000 | 0.200 | **0.2** | **0.2** | **0.2** | **0.2** | - | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.144 | 0.958 | - | - | **1.0** | **1.0** | - | **1.0** |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.727 | 1.575 | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.720 | 4.880 | 4.7 | 5.6 | 4.6 | 5.35 | - | 3.93 |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | - | **0.01** | **0.01** | **0.01** | **0.01** | - |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.017 | 0.055 | - | 0.058 | 0.059 | 0.044 | 0.057 | - |
| **Field Parameters** | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.5 | 6.2 | 6.7 | 6.4 | 6.2 | 6.7 | 6.7 | 6.8 |
| Specific Conductance (umhos/cm) | 570 | 323 | 142 | 1055 | 1223 | 1165 | 1040 | 1051 | 1319 | 671 |

**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

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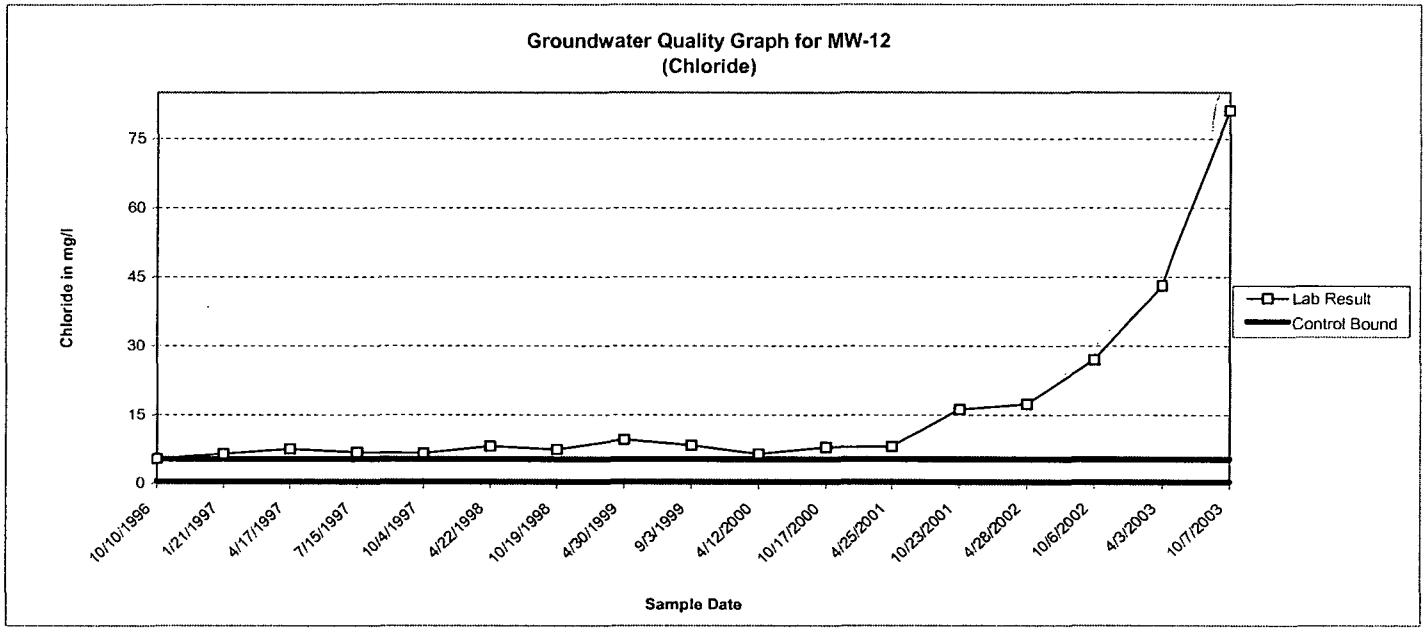
**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**TERRACON PROJECT NO. 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

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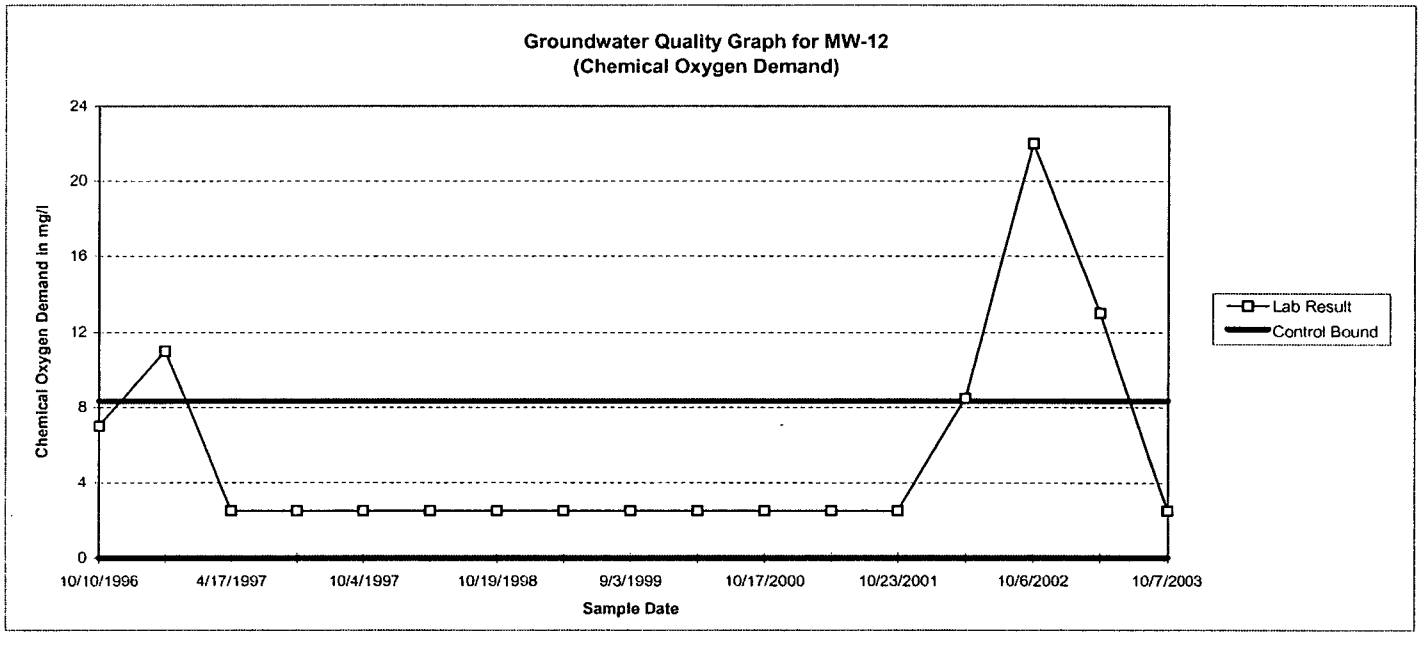


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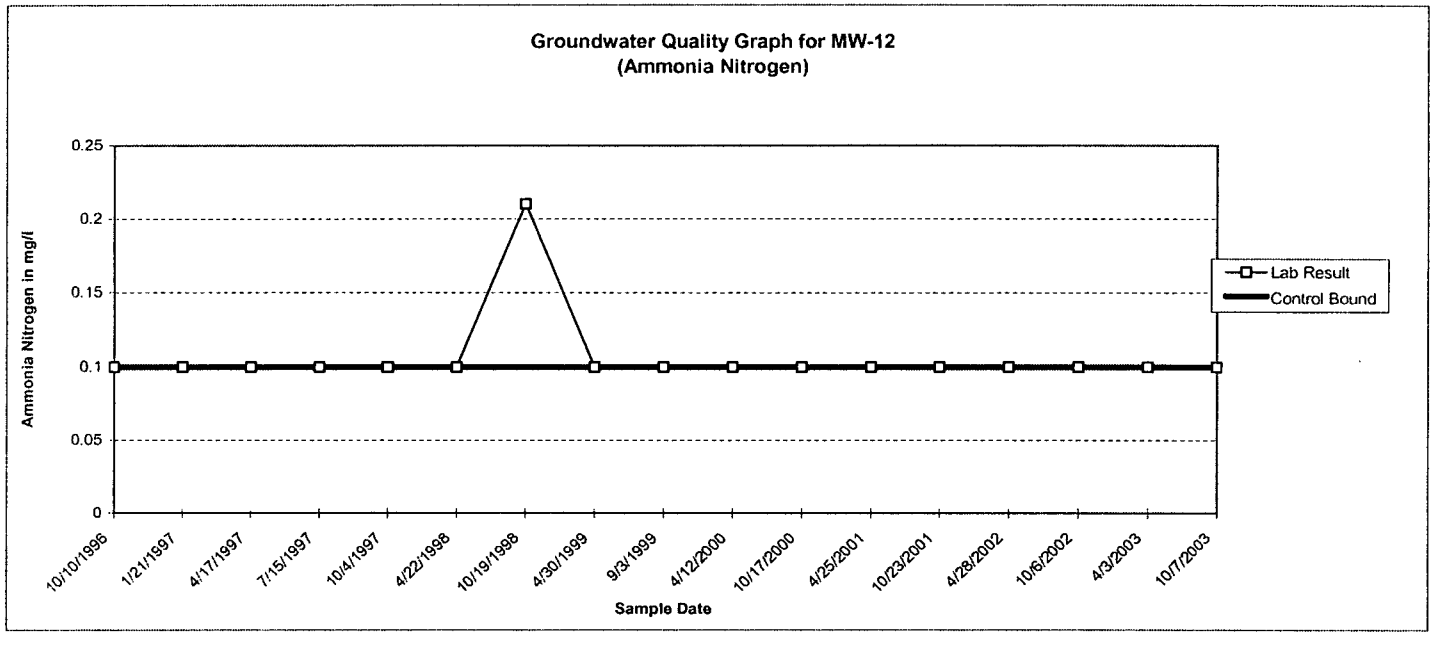


NOTE:
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2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

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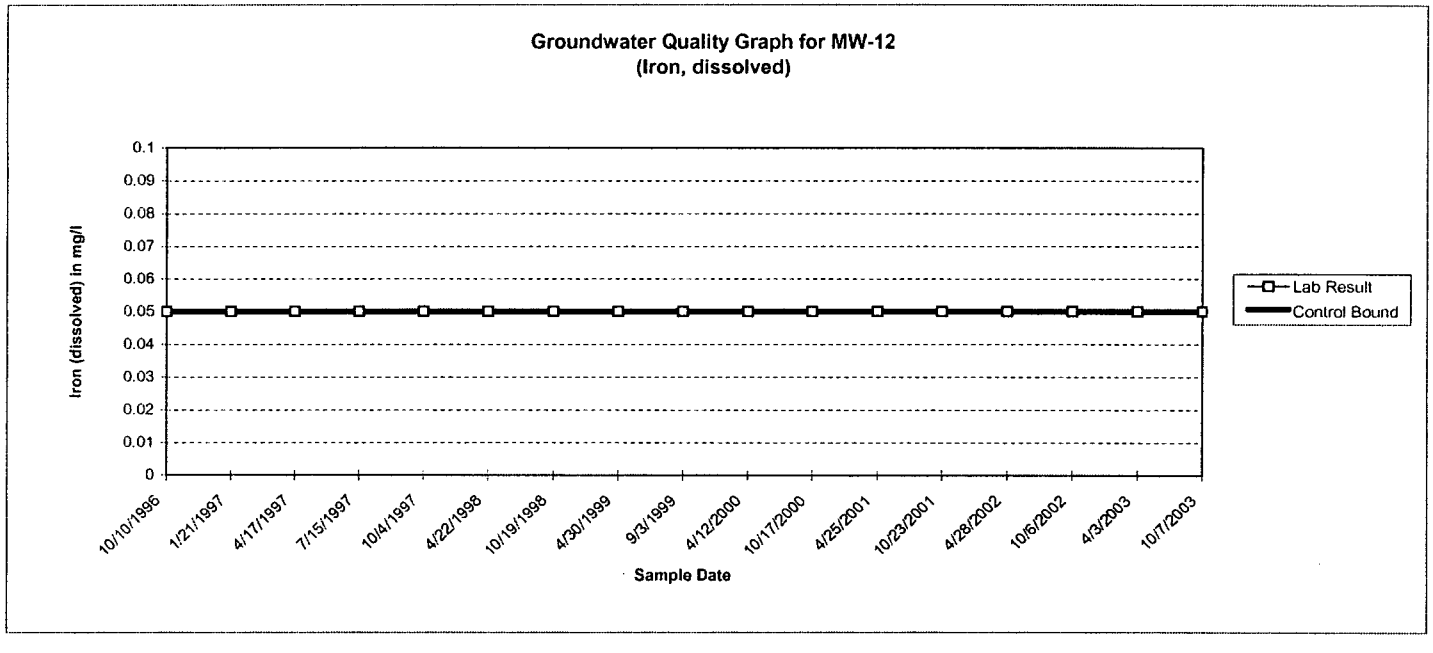


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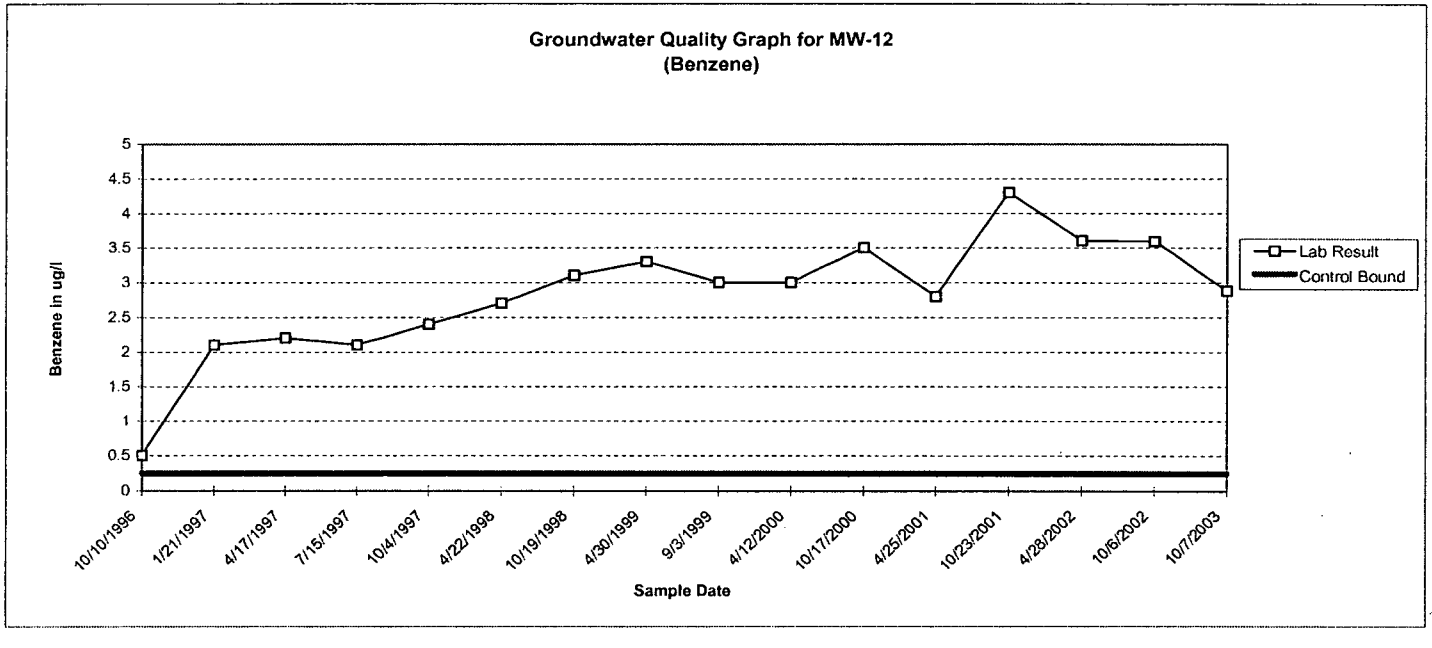


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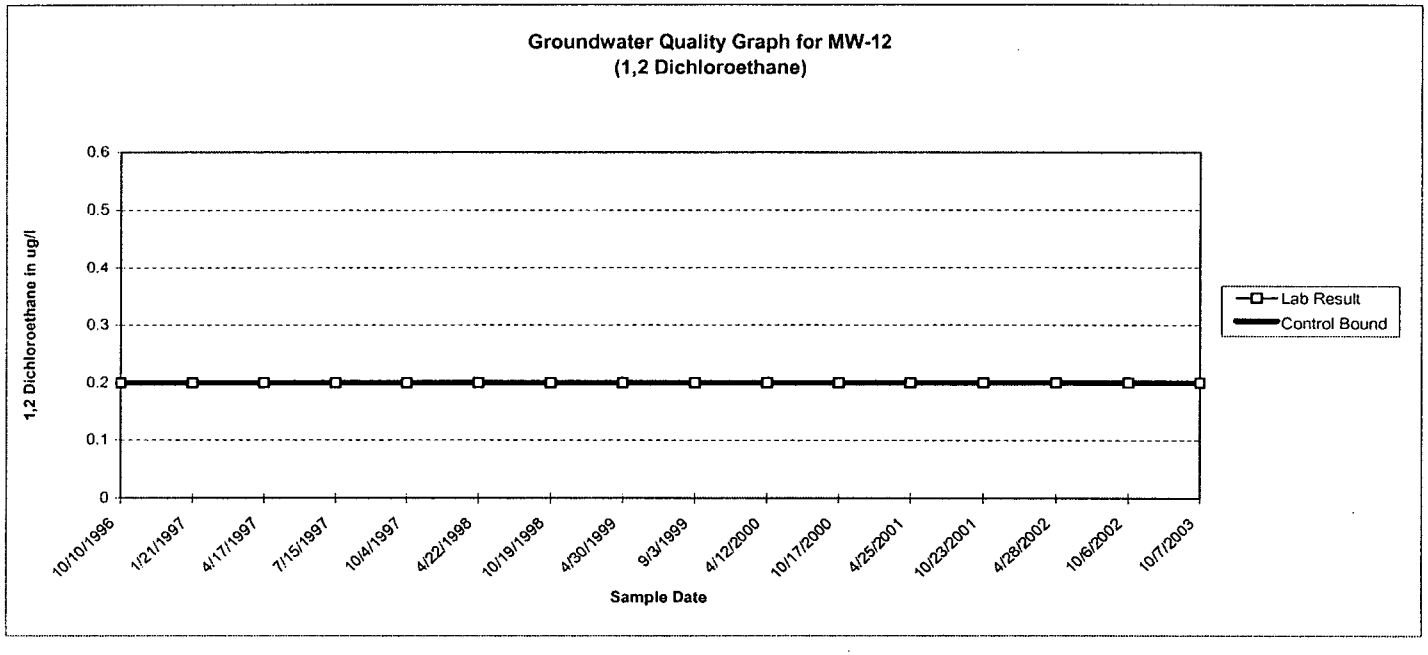


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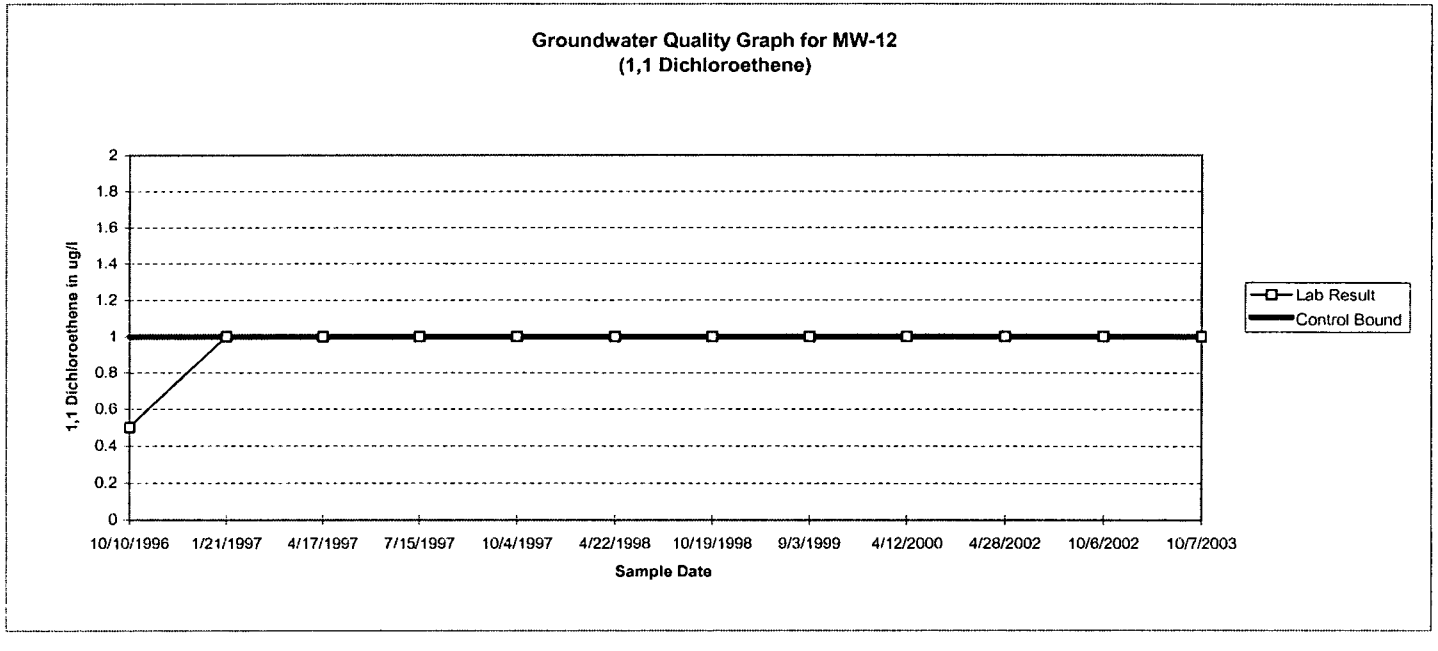


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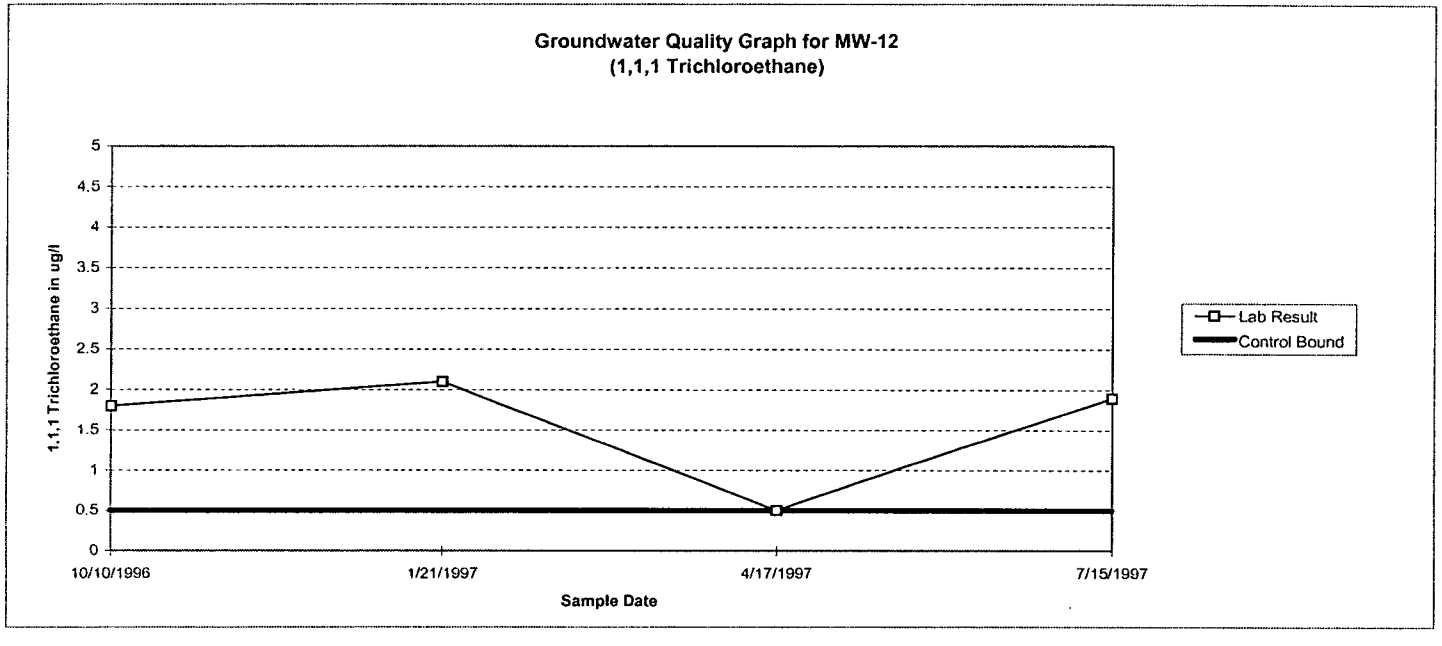


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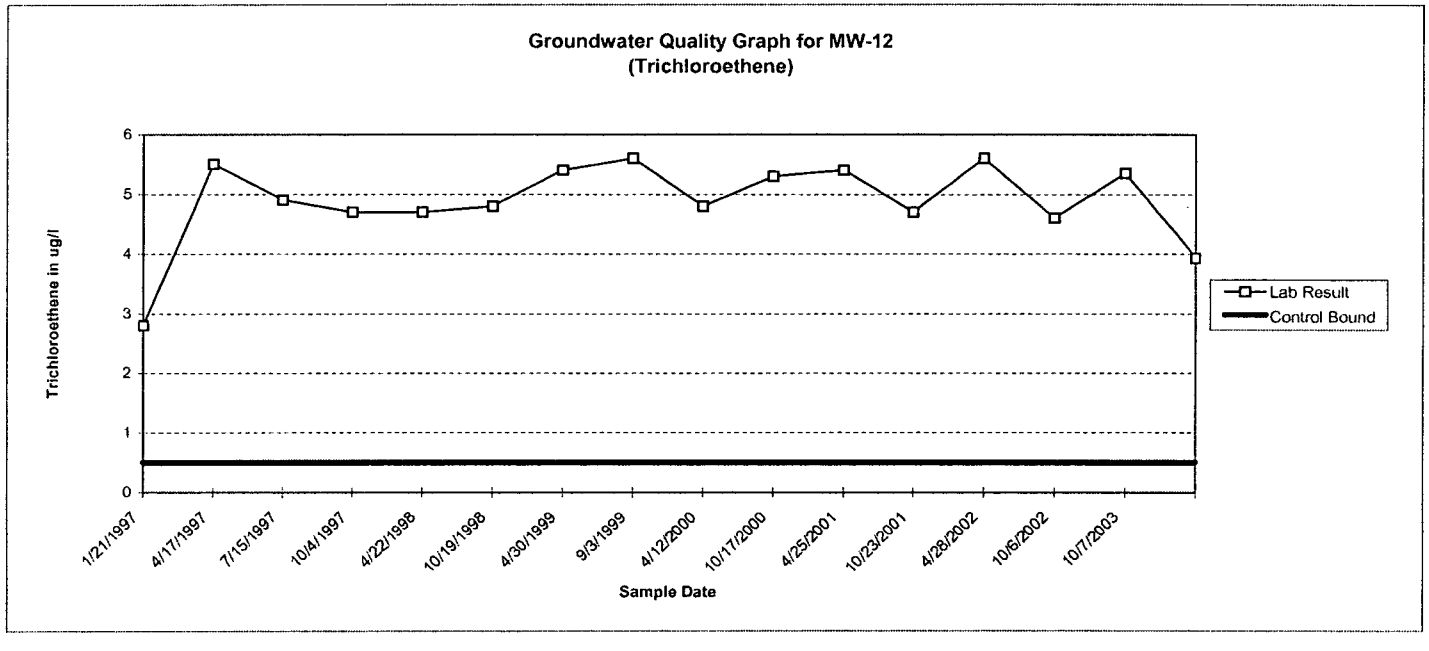


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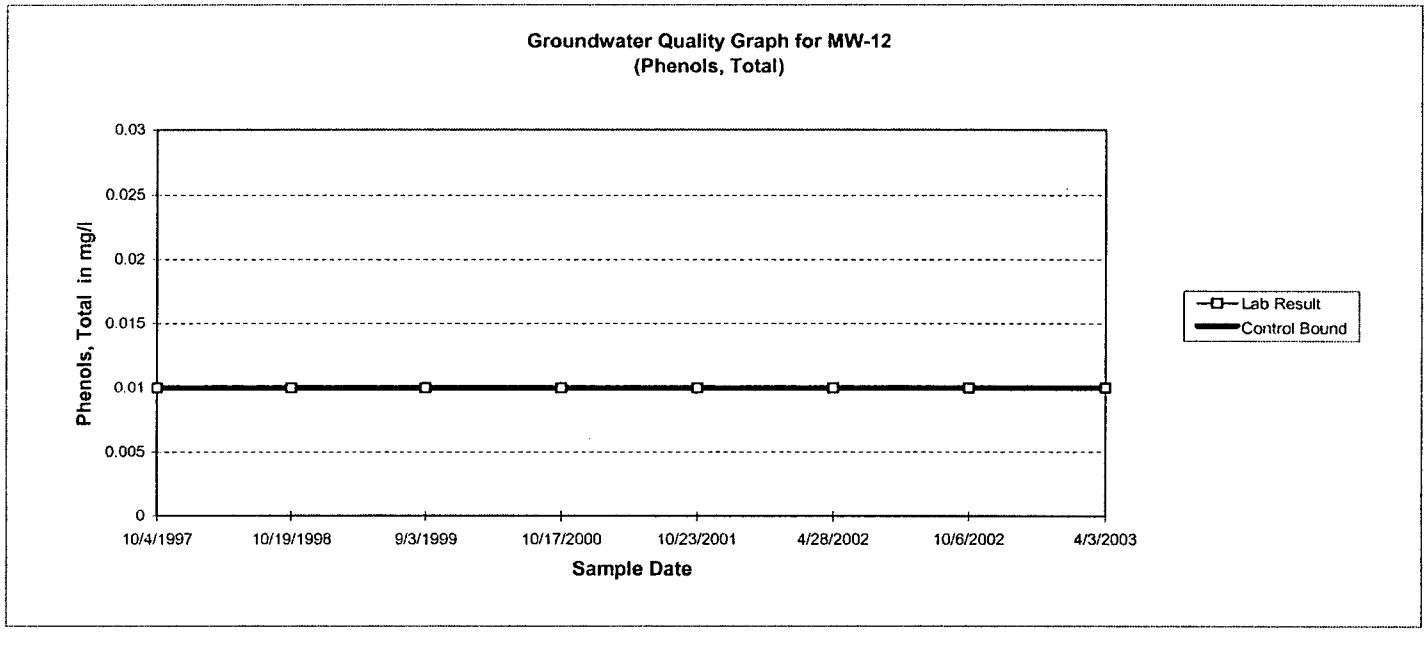


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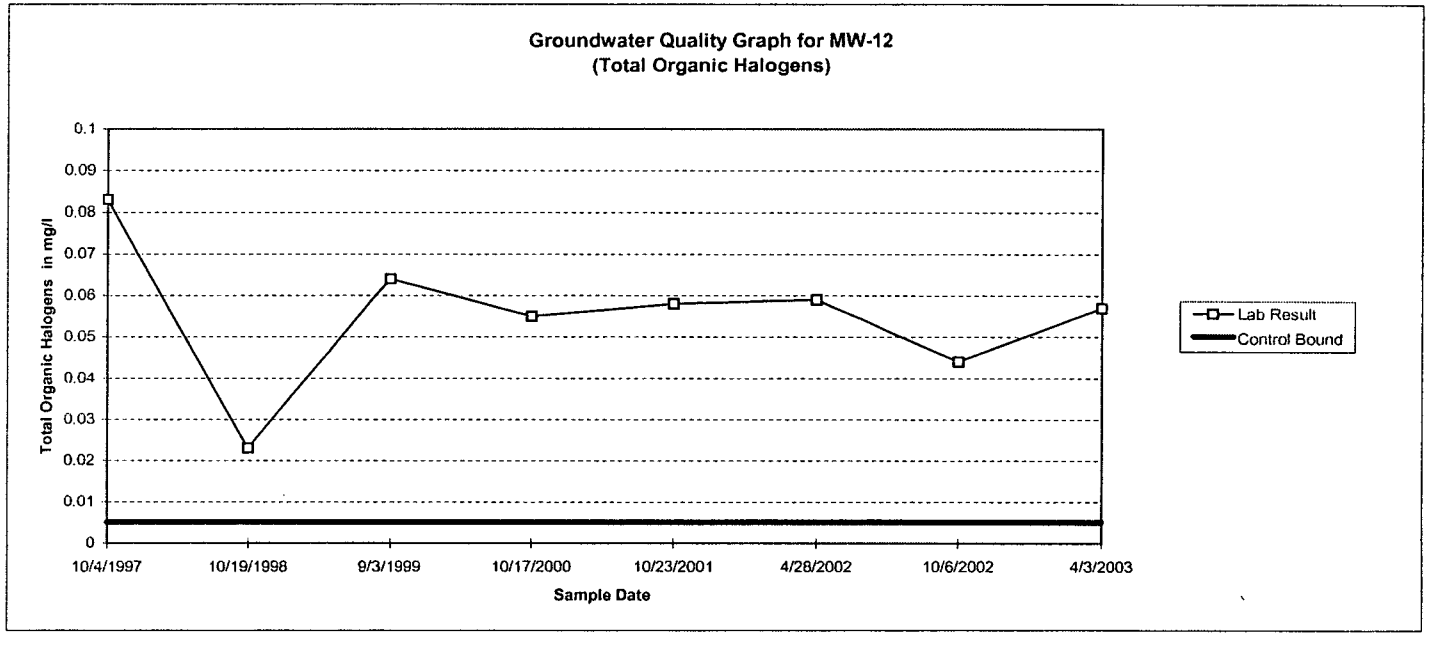


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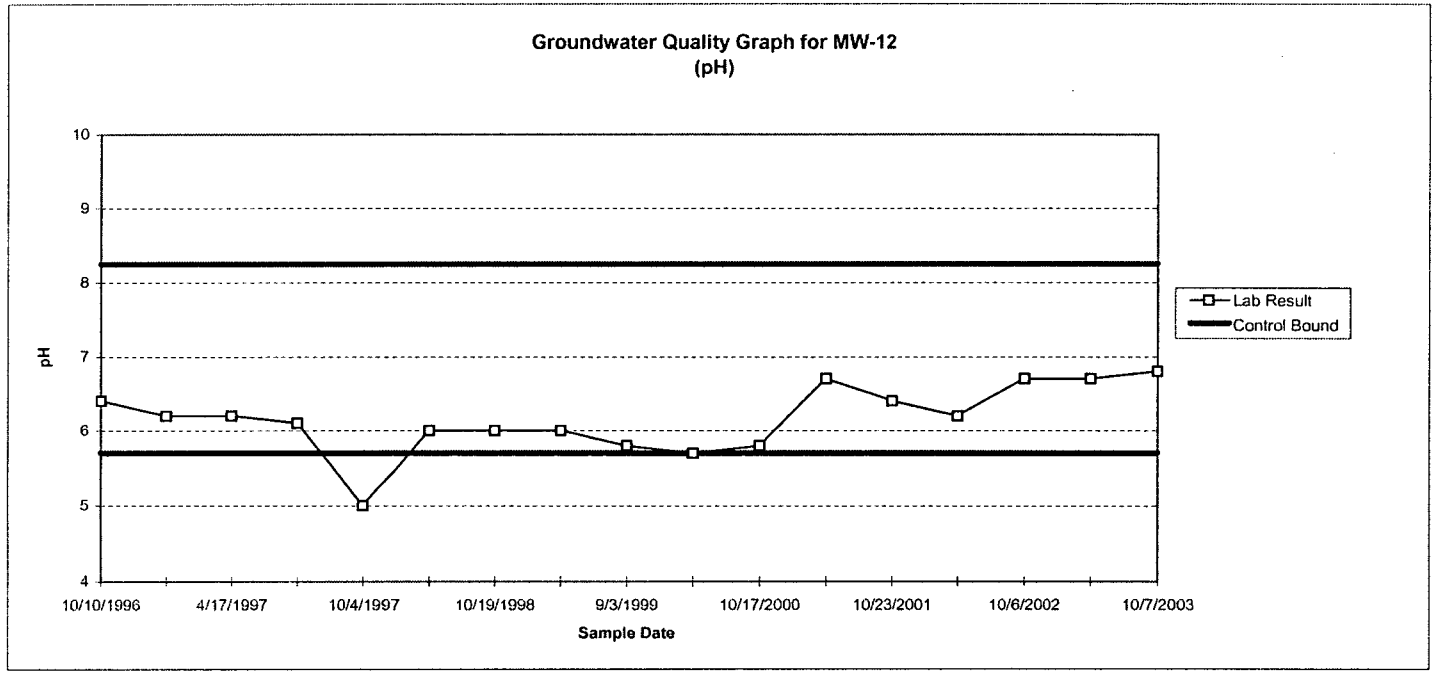


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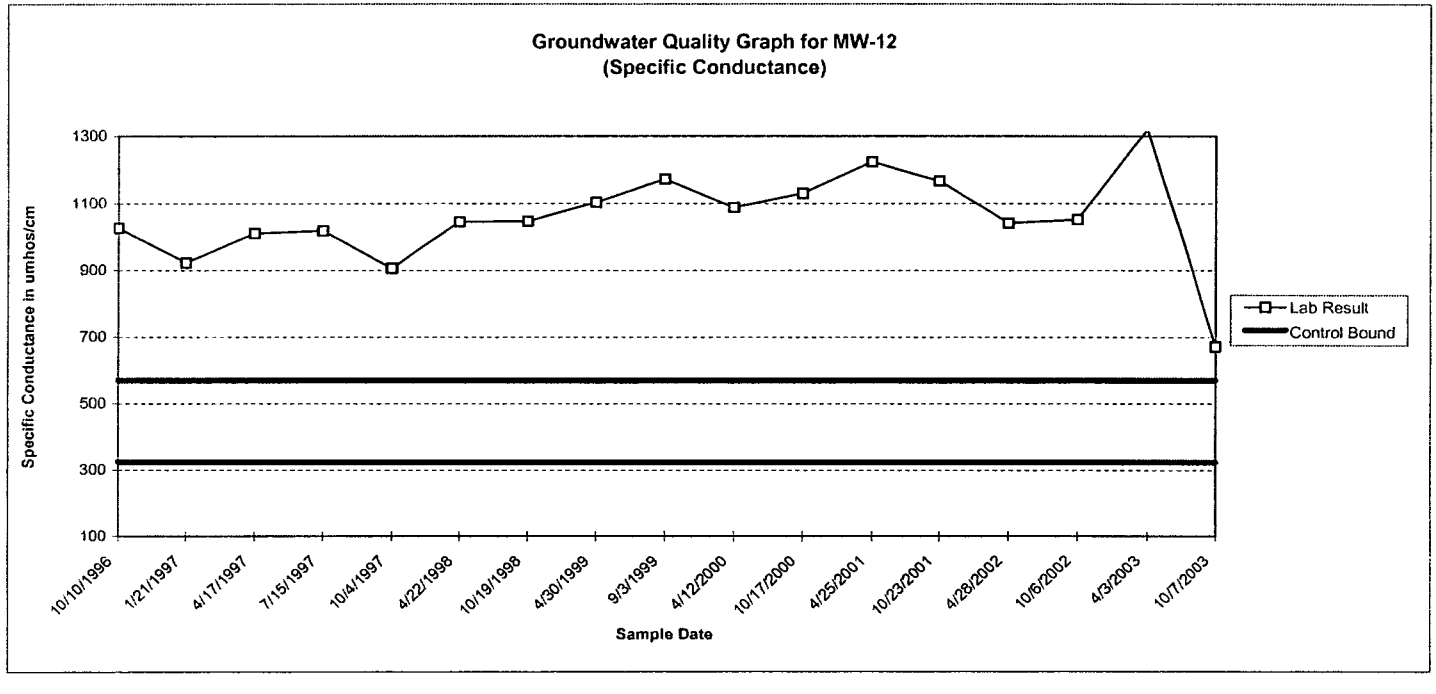


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## ANALYSIS SHEET MW-11

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

***SAMPLE LOCATION NO.*** ***MW-11*** ***(Down-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-11 Standard Deviation | MW-11 Mean | 7/12/1996 | 10/10/1996 | 1/21/1997 | 4/17/1997 | 10/4/1997 | 4/22/1998 | 10/19/1998 | 4/30/1999 | 9/3/1999 | 4/12/2000 | 10/17/2000 |
| **Laboratory Parameters** | | | | | | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 8.714 | 19.76 | 19 | 19 | 22 | 20 | 28 | 20.2 | 32 | 37 | 33 | 6.4 | 5.5 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 5.024 | 4.54 | 5.7 | 5.2 | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.10 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.861 | 0.26 | 3.6 | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.116 | 0.31 | **0.5** | **0.5** | **0.25** | **0.25** | - | - | - | - | - | - | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.106 | 0.24 | **0.5** | **0.2** | **0.2** | **0.2** | - | - | - | - | - | - | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.274 | 0.80 | **0.5** | **0.5** | **1.0** | **1.0** | - | - | - | - | - | - | - |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.300 | 0.65 | **0.5** | 1.1 | **0.5** | **0.5** | - | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.000 | 0.50 | **0.5** | **0.5** | **0.5** | **0.5** | - | - | - | - | - | - | **0.5** |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.01 | - | - | - | - | **0.01** | - | **0.01** | - | **0.01** | - | **0.01** |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.004 | 0.01 | - | - | - | - | **0.005** | - | 0.015 | - | 0.011 | - | **0.005** |
| **Field Parameters** | | | | | | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.3 | 6.9 | 6.6 | 6.8 | 6.8 | 6.6 | 6.8 | 6.7 | 6.7 | 6.5 | 6.5 | 7.1 | 6.9 |
| Specific Conductance (umhos/cm) | 570 | 323 | 117 | 652 | 465 | 622 | 515 | 537 | 543 | 625 | 667 | 707 | 736 | 737 | 740 |

**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
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## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

***SAMPLE LOCATION NO.*** ***MW-11*** ***(Down-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-11 Standard Deviation | MW-11 Mean | 4/25/2001 | 10/23/2001 | 4/28/2002 | 10/6/2002 | 4/3/2003 | 10/7/2003 |
| **Laboratory Parameters** | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 8.714 | 19.76 | 12.9 | 16.0 | 18.0 | 18.8 | 12.3 | 15.8 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 5.271 | 4.453 | **2.5** | **2.5** | 5.4 | 23 | 7.8 | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.10 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.861 | 0.26 | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.116 | 0.31 | **0.25** | **0.25** | - | - | - | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.106 | 0.24 | **0.2** | **0.2** | - | - | - | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.274 | 0.80 | - | - | - | - | - | **1.0** |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.300 | 0.65 | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.000 | 0.50 | **0.5** | **0.5** | - | - | - | **0.5** |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.01 | - | **0.01** | **0.01** | **0.01** | **0.01** | - |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.004 | 0.01 | - | **0.005** | **0.005** | **0.005** | **0.005** | - |
| **Field Parameters** | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.3 | 6.9 | 7.1 | 7.2 | 6.3 | 7.3 | 7.2 | 7.5 |
| Specific Conductance (umhos/cm) | 570 | 323 | 117 | 652 | 428 | 733 | 784 | 684 | 735 | 832 |

**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
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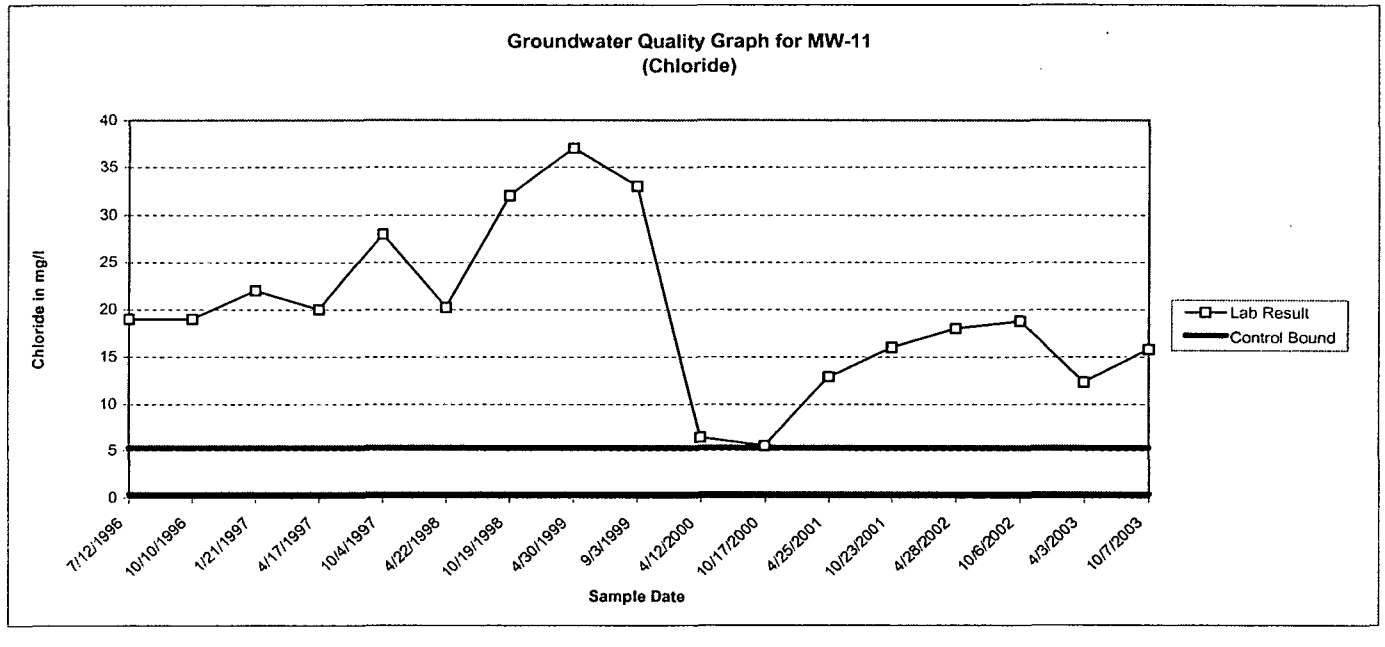


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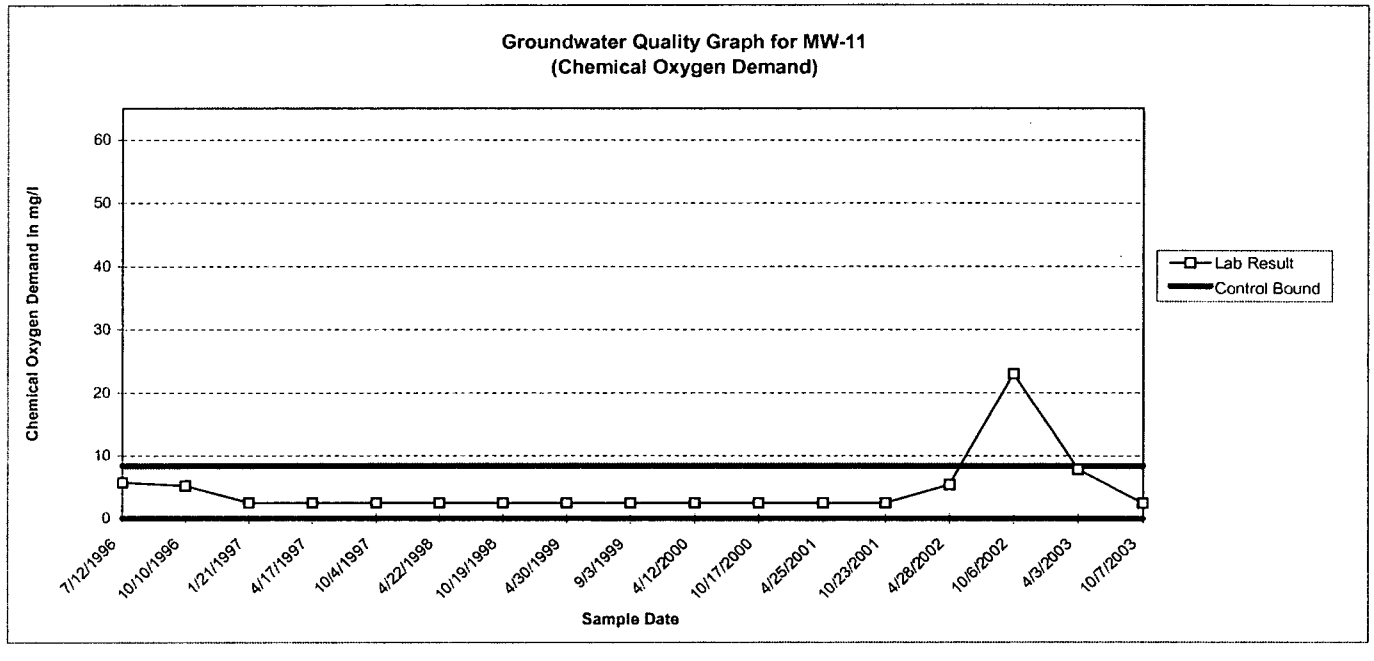


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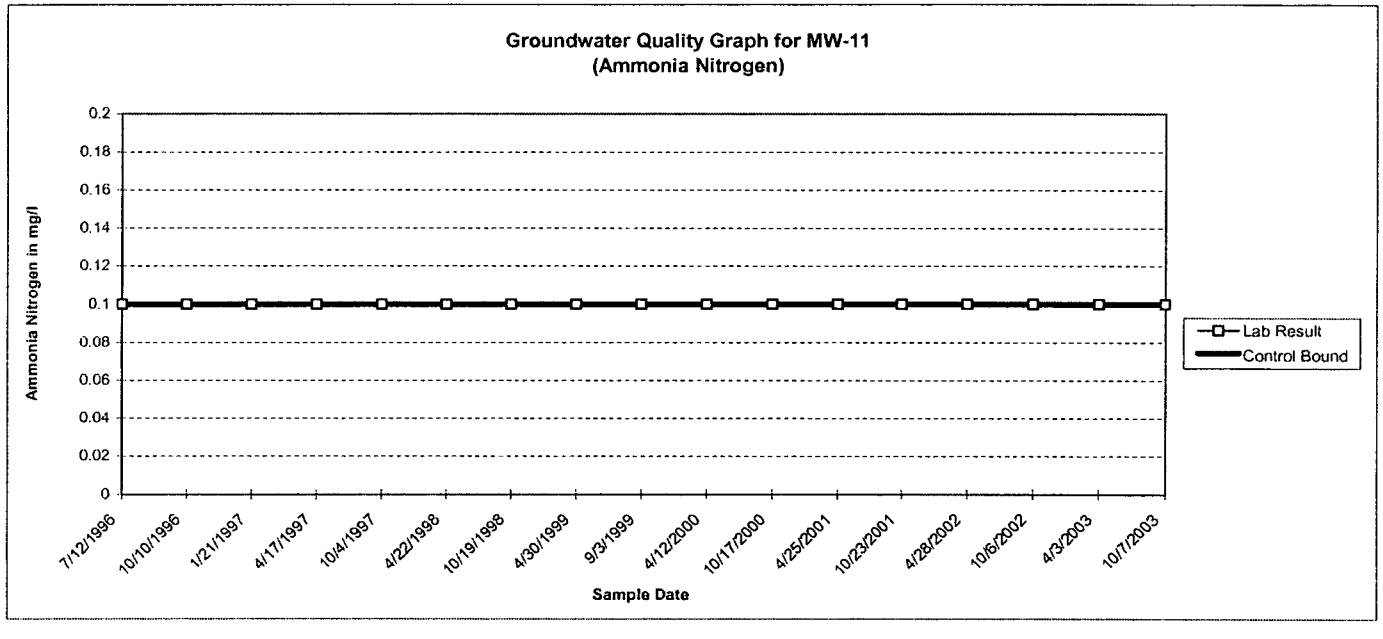


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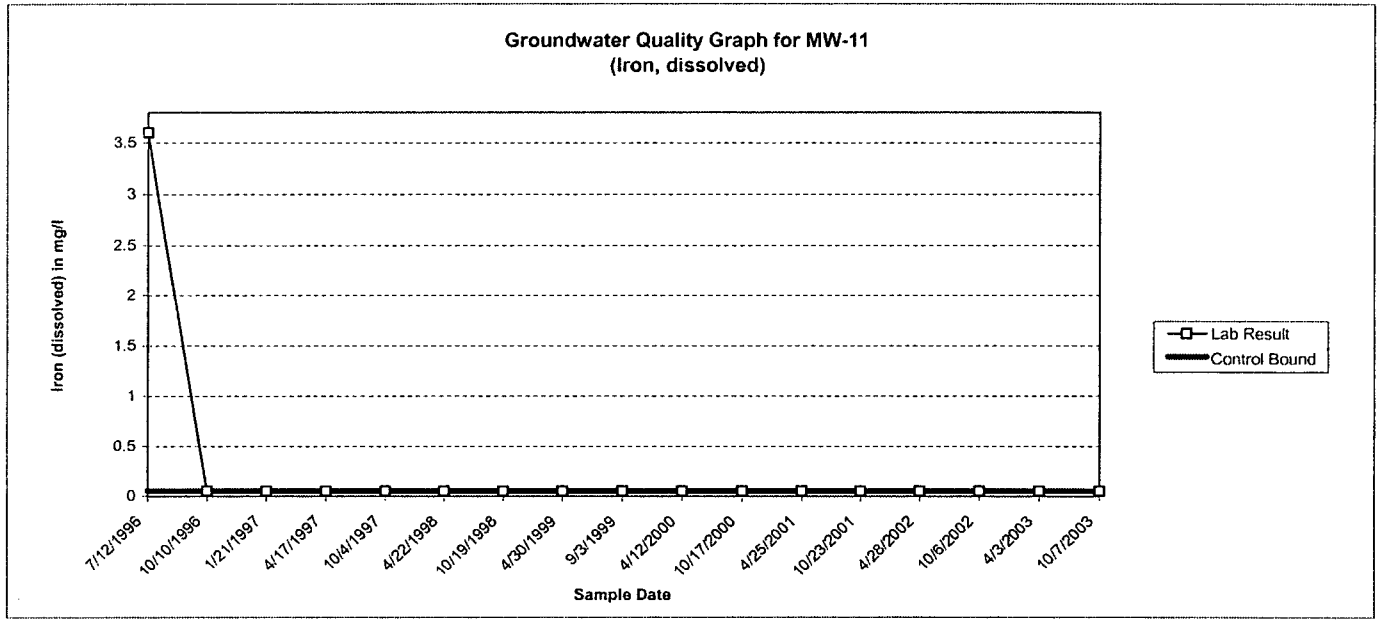
## ANALYSIS SHEET MW-11

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

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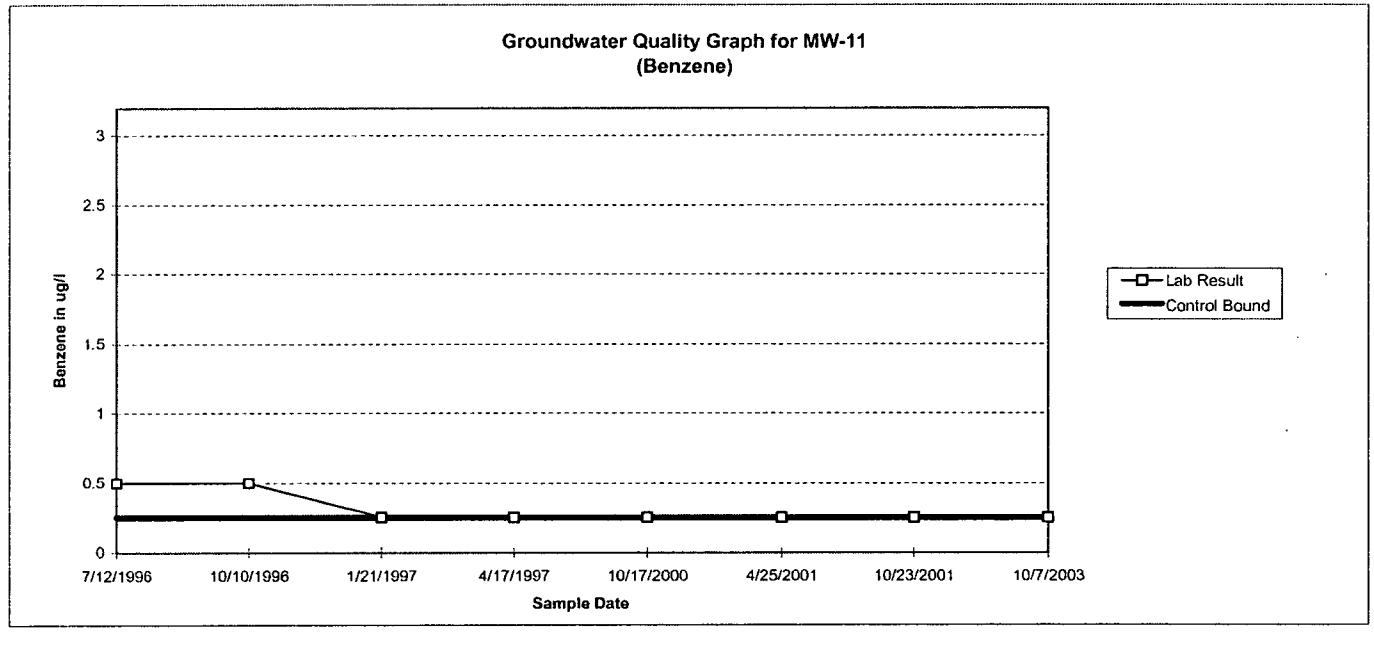


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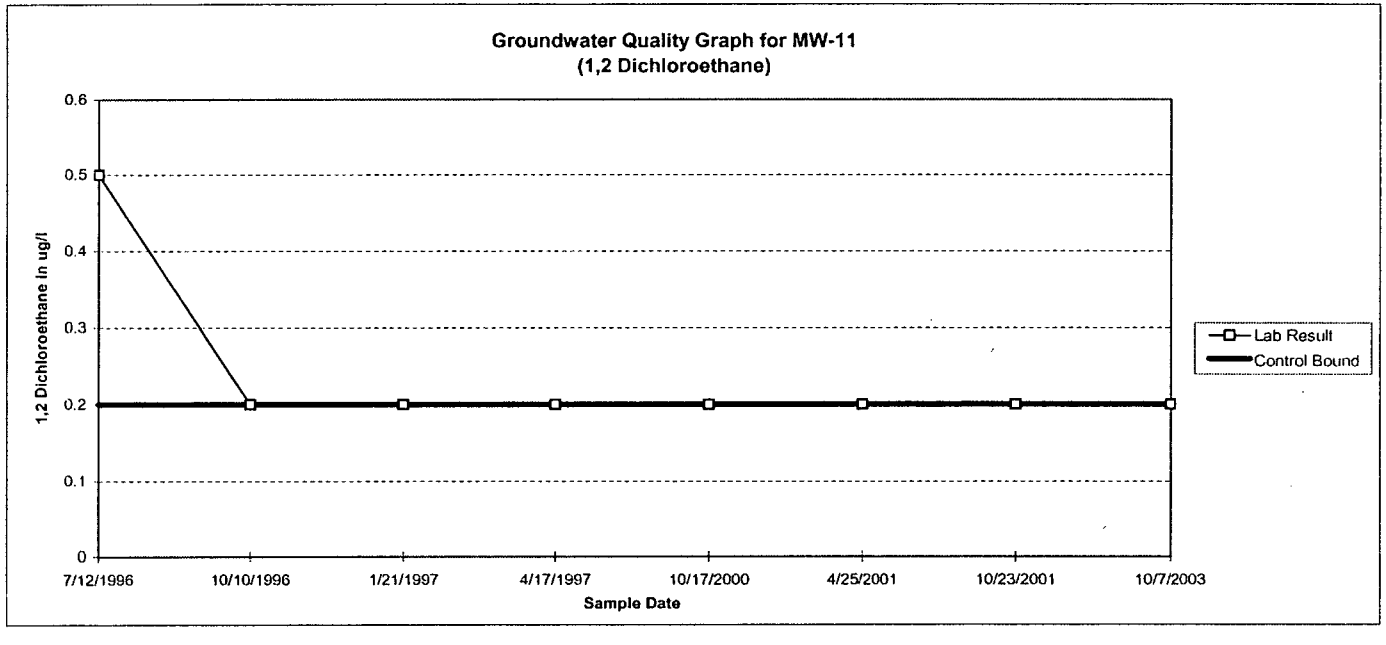


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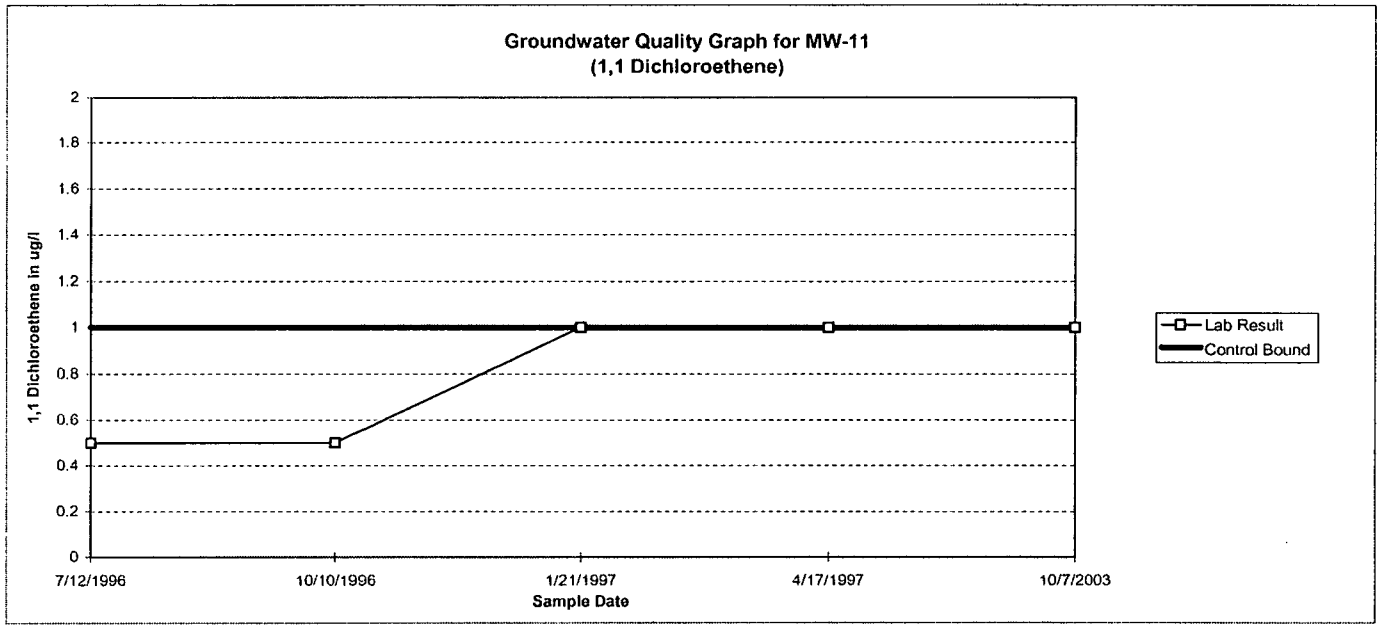


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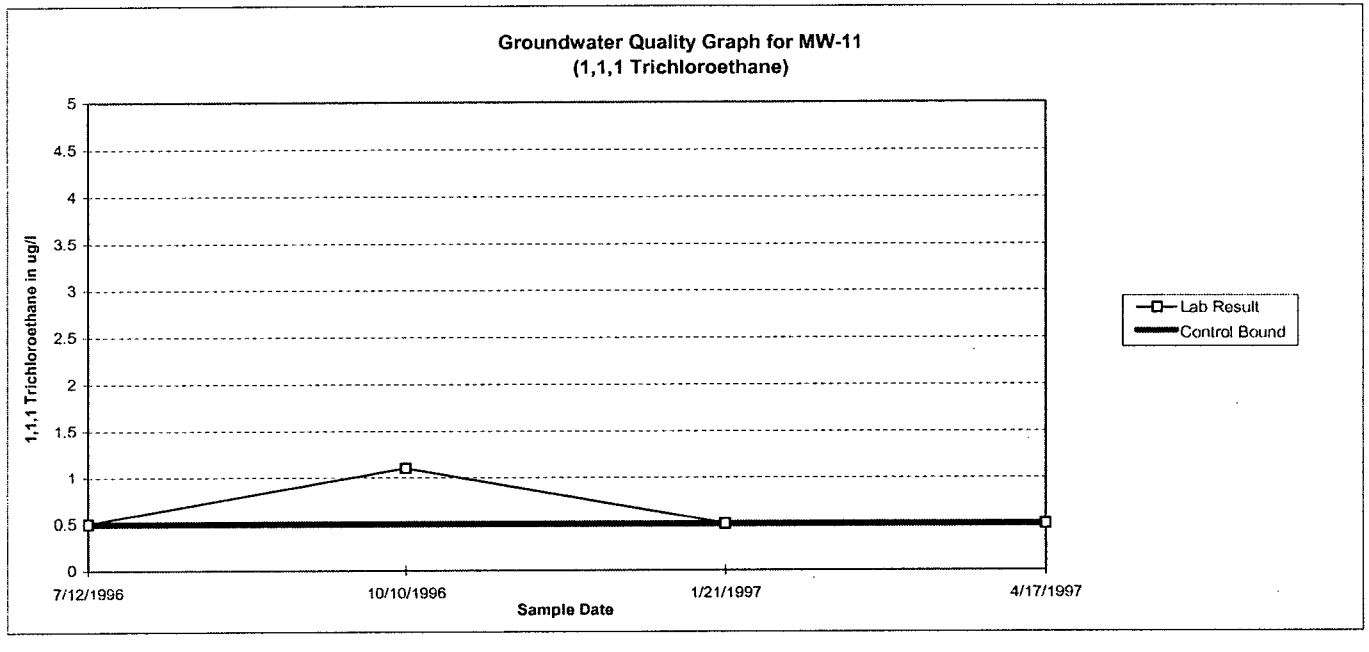


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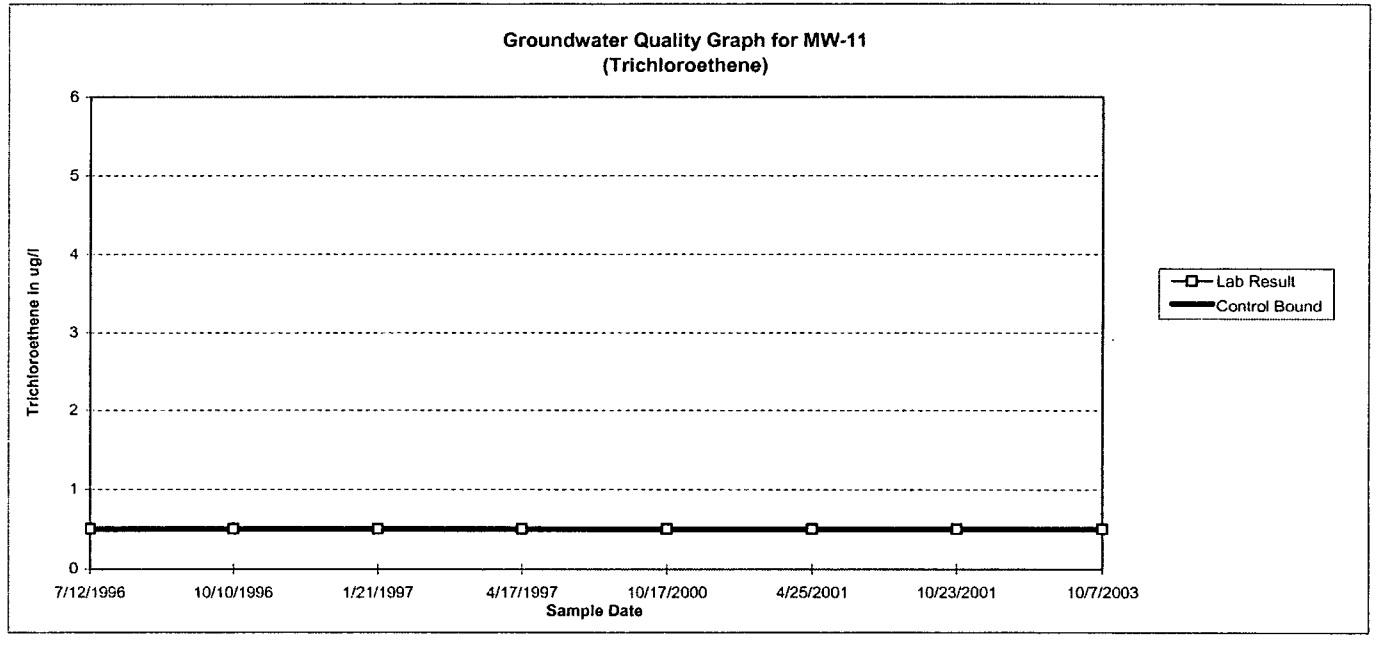


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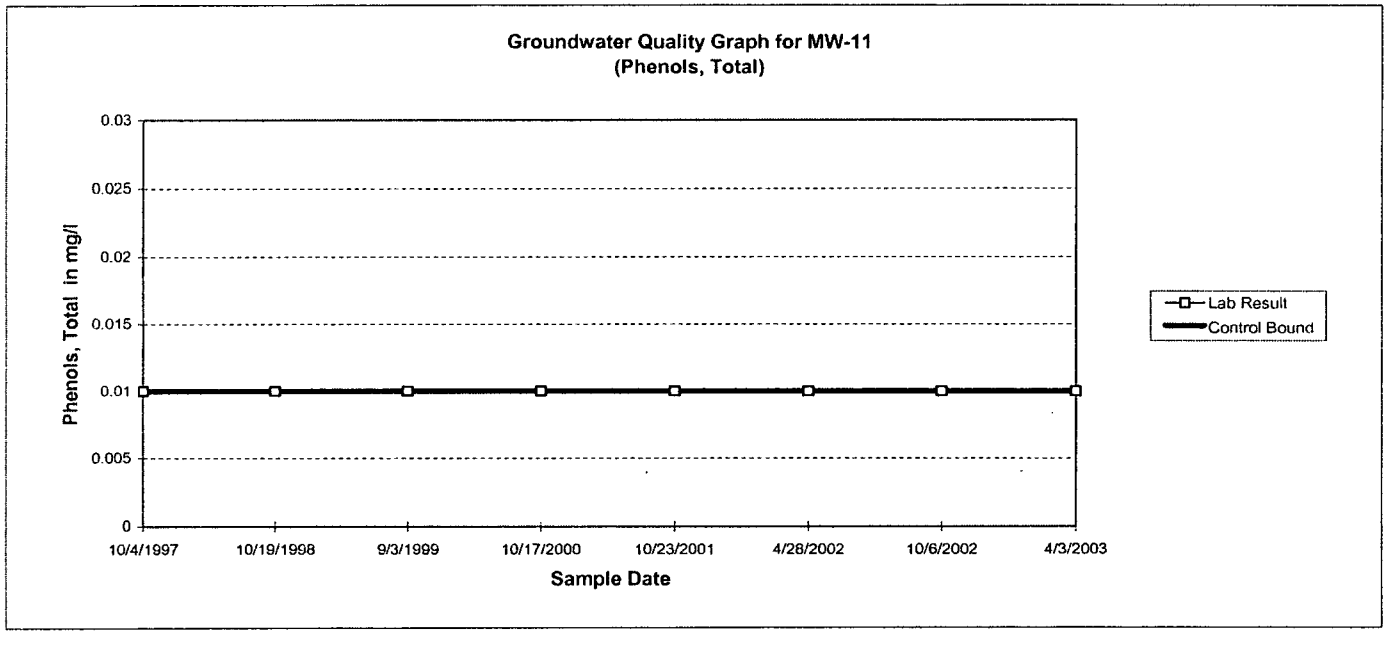


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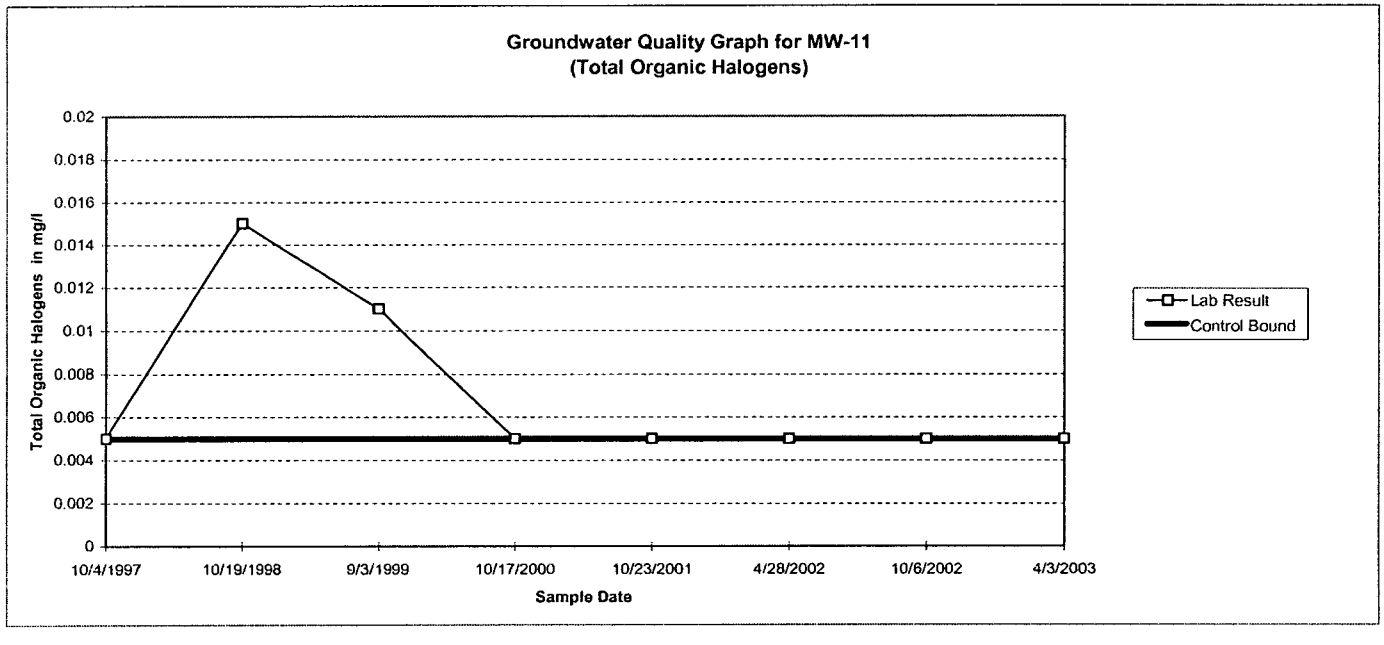


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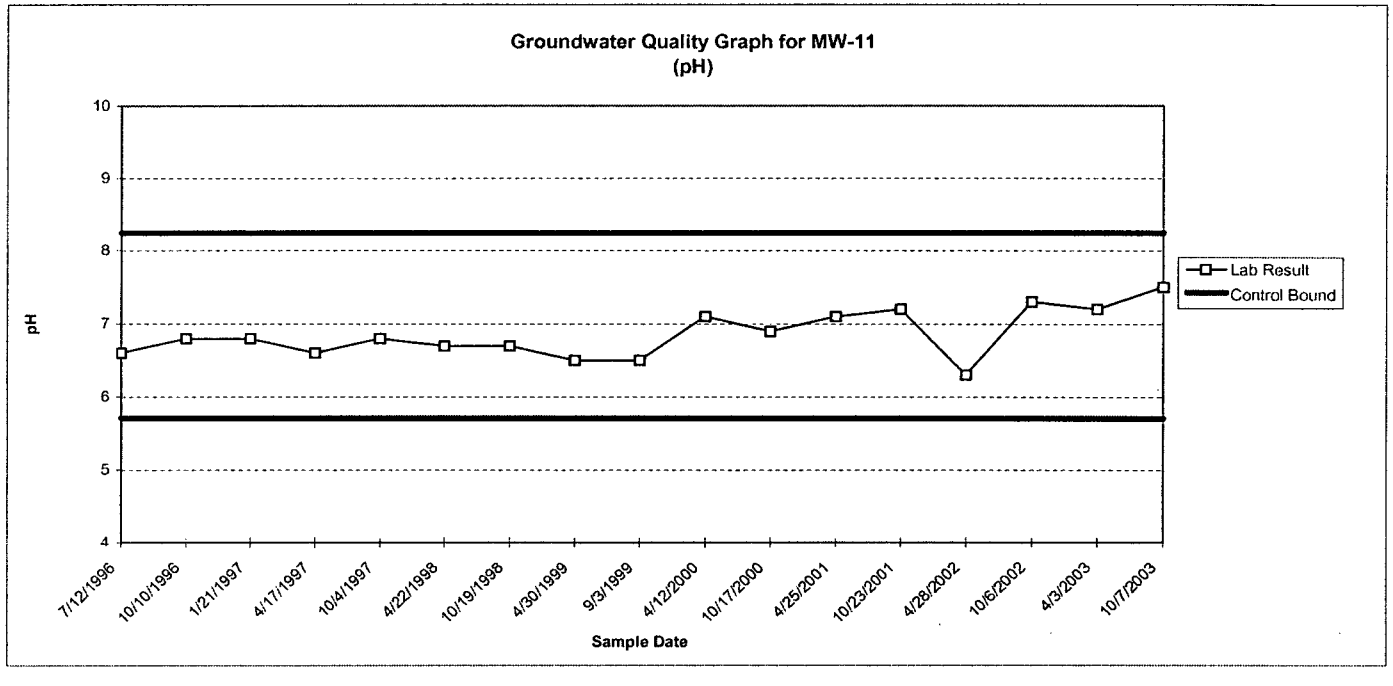


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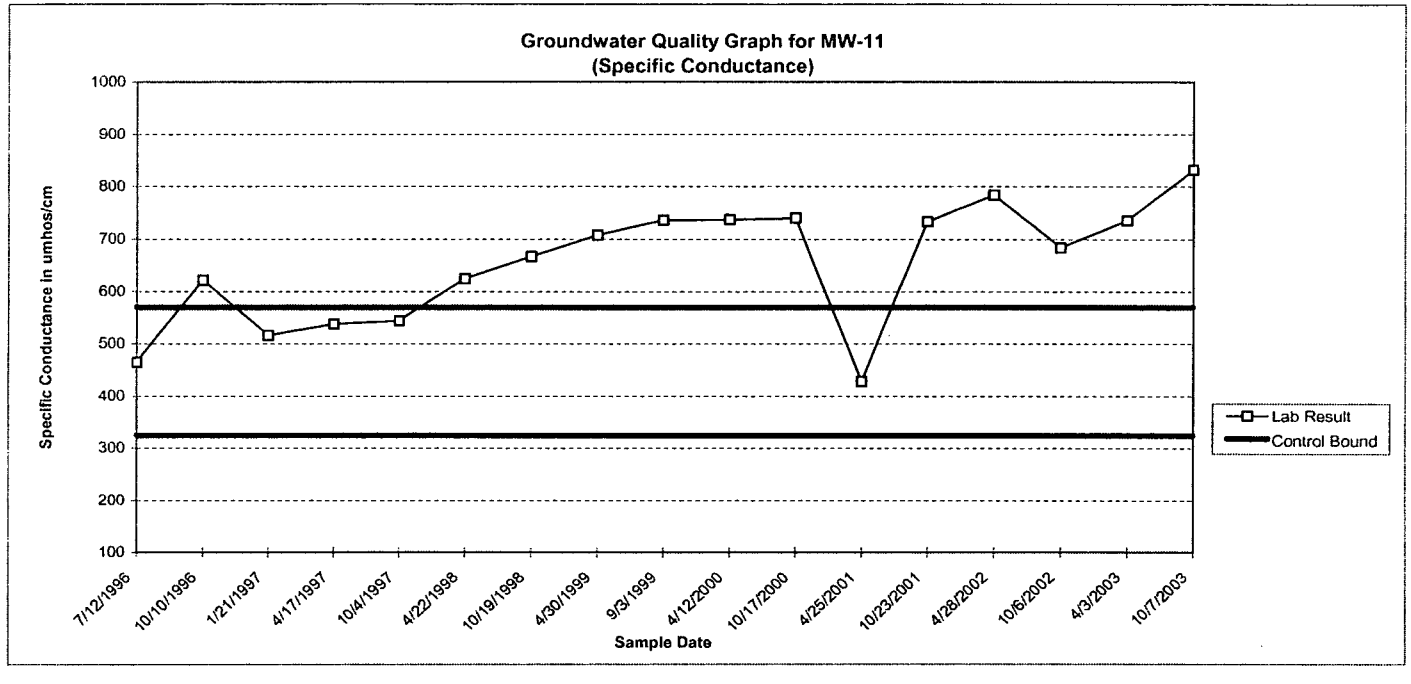


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## ANALYSIS SHEET MW-10

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

***SAMPLE LOCATION NO.*** ***MW-10 (Down-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-10 Standard Deviation | MW-10 Mean | 8/9/1996 | 10/10/1996 | 1/21/1997 | 4/17/1997 | 10/4/1997 | 4/22/1998 | 10/19/1998 | 4/30/1999 | 9/1/1999 | 4/12/2000 | 10/17/2000 |
| **Laboratory Parameters** | | | | | | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 2.968 | 18.85 | 13 | 14 | 15 | 22 | 19 | 19.6 | 20 | 21 | 21 | 18.6 | 19.7 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 35.392 | 14.78 | 140.0 | **2.5** | 5.7 | **2.5** | **2.5** | **2.5** | **2.5** | 63 | **2.5** | **2.5** | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.243 | 0.16 | 1.1 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.024 | 0.06 | **0.05** | **0.05** | **0.05** | 0.15 | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.116 | 0.31 | **0.5** | **0.5** | **0.25** | **0.25** | - | - | - | - | - | - | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.106 | 0.24 | **0.5** | **0.2** | **0.2** | **0.2** | - | - | - | - | - | - | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.274 | 0.80 | **0.5** | **0.5** | **1.0** | **1.0** | - | - | - | - | - | - | - |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.000 | 0.50 | **0.5** | **0.5** | **0.5** | **0.5** | - | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.177 | 0.56 | **0.5** | **0.5** | 1.0 | **0.5** | - | - | - | - | - | - | **0.5** |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.007 | 0.01 | - | - | - | - | 0.03 | - | **0.01** | - | **0.01** | - | **0.01** |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.005 | 0.01 | - | - | - | - | 0.012 | - | 0.019 | - | 0.013 | - | 0.011 |
| **Field Parameters** | | | | | | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.5 | 6.7 | 8.1 | 6.7 | 6.8 | 6.5 | 6.5 | 6.4 | 6.5 | 6.4 | 6.3 | 6.3 | 6.4 |
| Specific Conductance (umhos/cm) | 570 | 323 | 87 | 679 | 787 | 695 | 625 | 724 | 644 | 684 | 742 | 713 | 774 | 700 | 729 |

**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-10

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## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

***SAMPLE LOCATION NO.*** ***MW-10 (Down-gradient)***

***ANALYSIS PERFORMED BY:*** ***TestAmerica Laboratories*** ***SAMPLED BY:*** ***Plymouth County Landfill Personnel***

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-10 Standard Deviation | MW-10 Mean | 4/25/2001 | 10/23/2001 | 4/28/2002 | 10/6/2002 | 4/3/2003 | 10/7/2003 |
| **Laboratory Parameters** | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 2.968 | 18.85 | 16.7 | 18.6 | 17.9 | 17.8 | 23 | 23.6 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 35.392 | 14.78 | **2.5** | **2.5** | 5.7 | 6.9 | **2.5** | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.243 | 0.16 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.024 | 0.06 | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.116 | 0.31 | **0.25** | **0.25** | - | - | - | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.106 | 0.24 | **0.2** | **0.2** | - | - | - | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.274 | 0.80 | - | - | - | - | - | **1.0** |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.000 | 0.50 | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.177 | 0.56 | **0.5** | **0.5** | - | - | - | **0.5** |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.007 | 0.01 | - | **0.01** | 0.01 | **0.01** | **0.01** | - |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.005 | 0.01 | - | **0.005** | 0.005 | 0.012 | **0.005** | - |
| **Field Parameters** | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.5 | 6.7 | 7.0 | 6.9 | 6.5 | 7.1 | 7.0 | 7.3 |
| Specific Conductance (umhos/cm) | 570 | 323 | 87 | 679 | 570 | 740 | 463 | 645 | 753 | 550 |

**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
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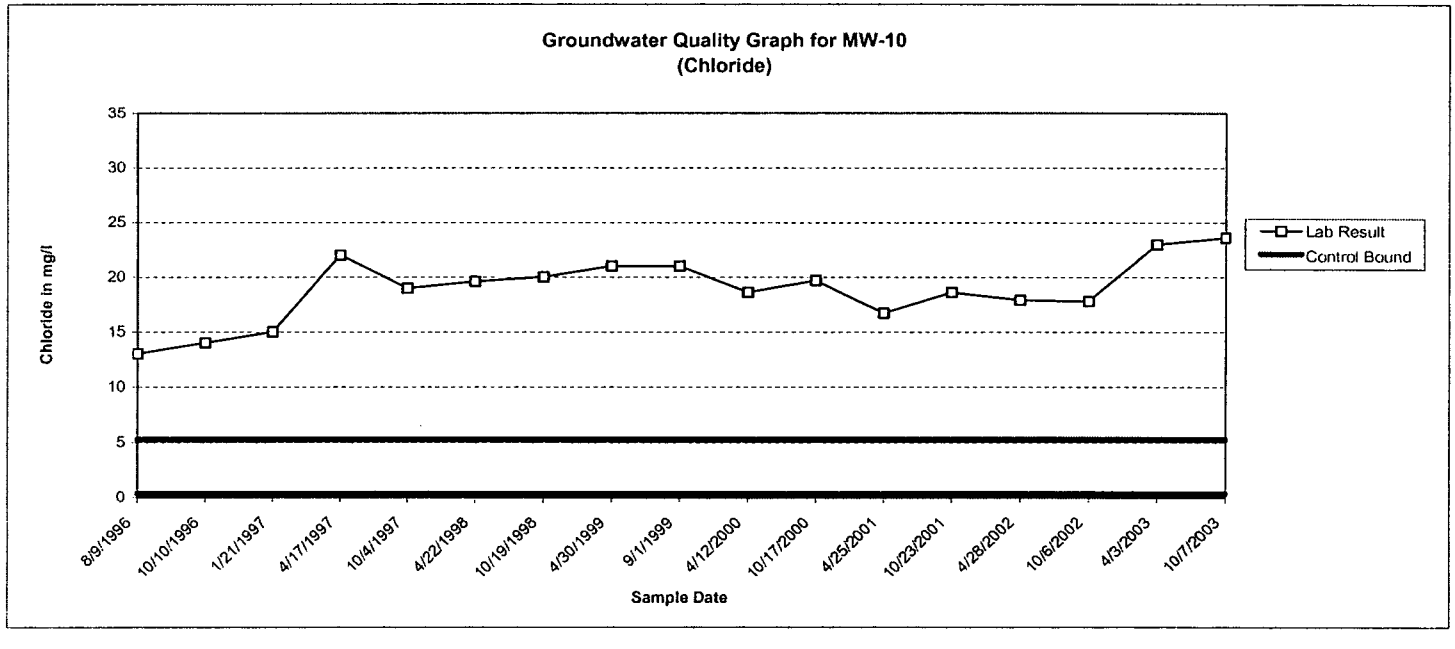


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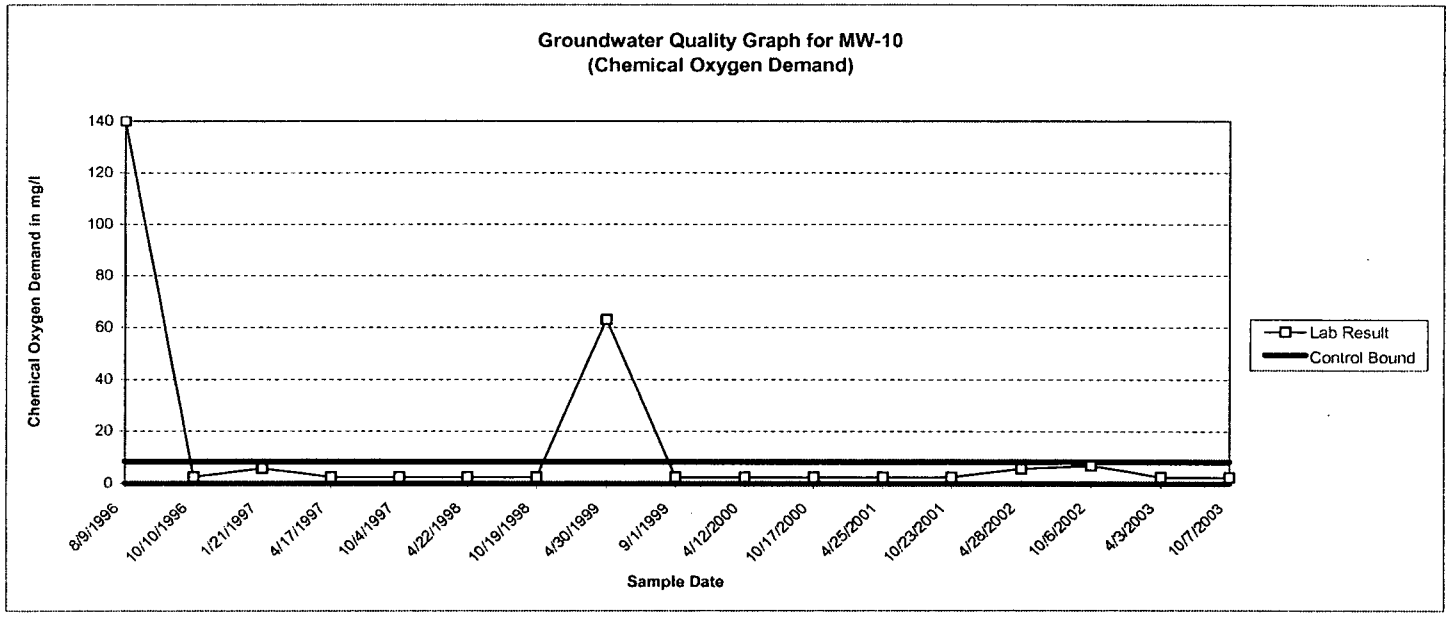


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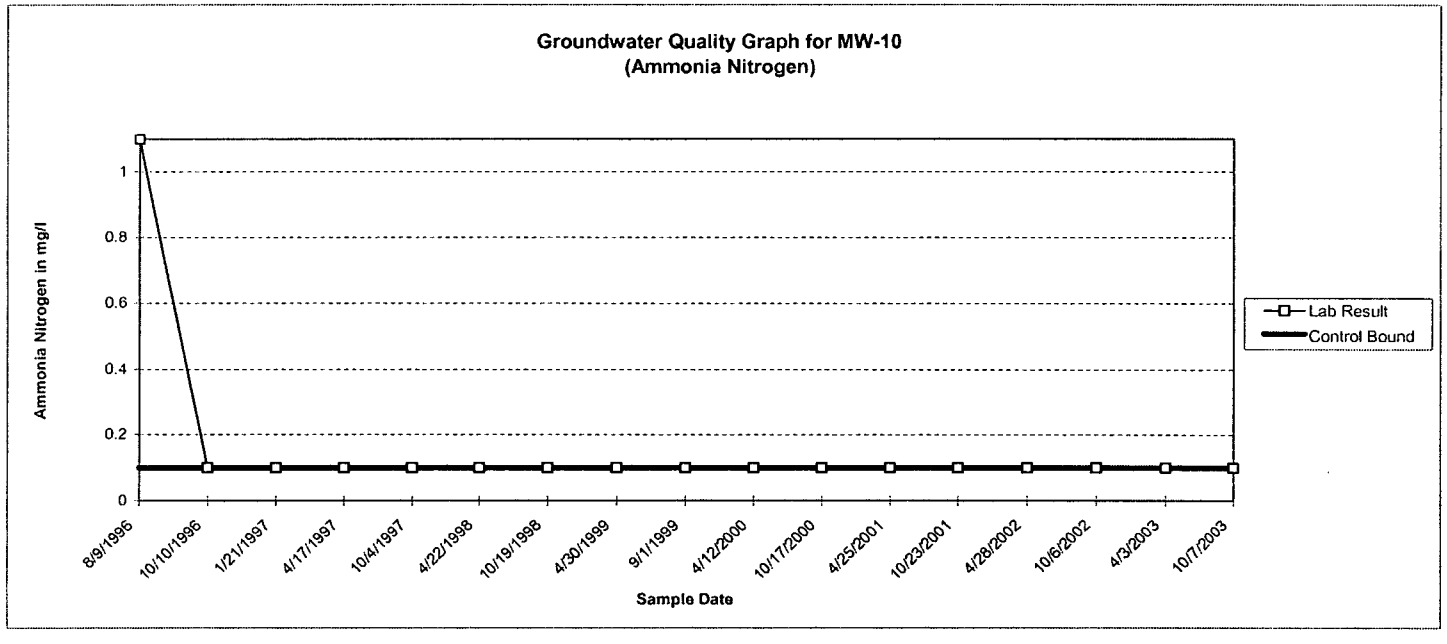


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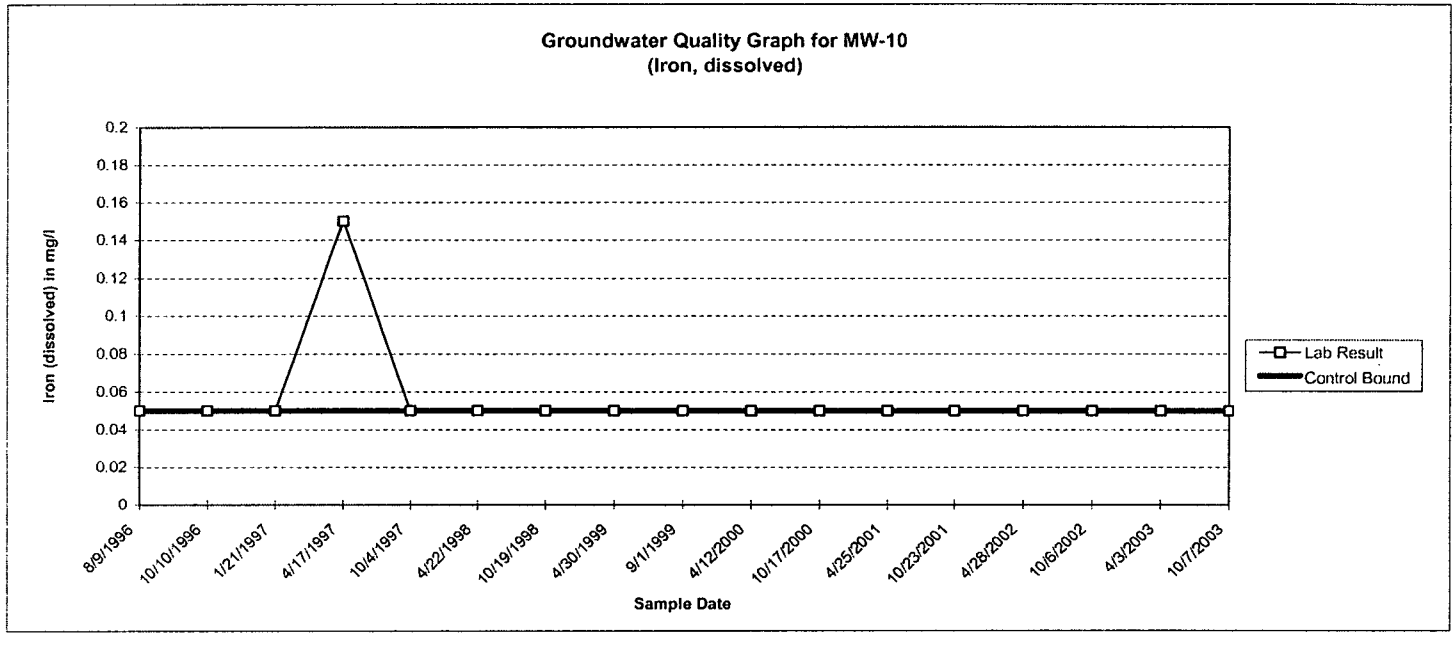


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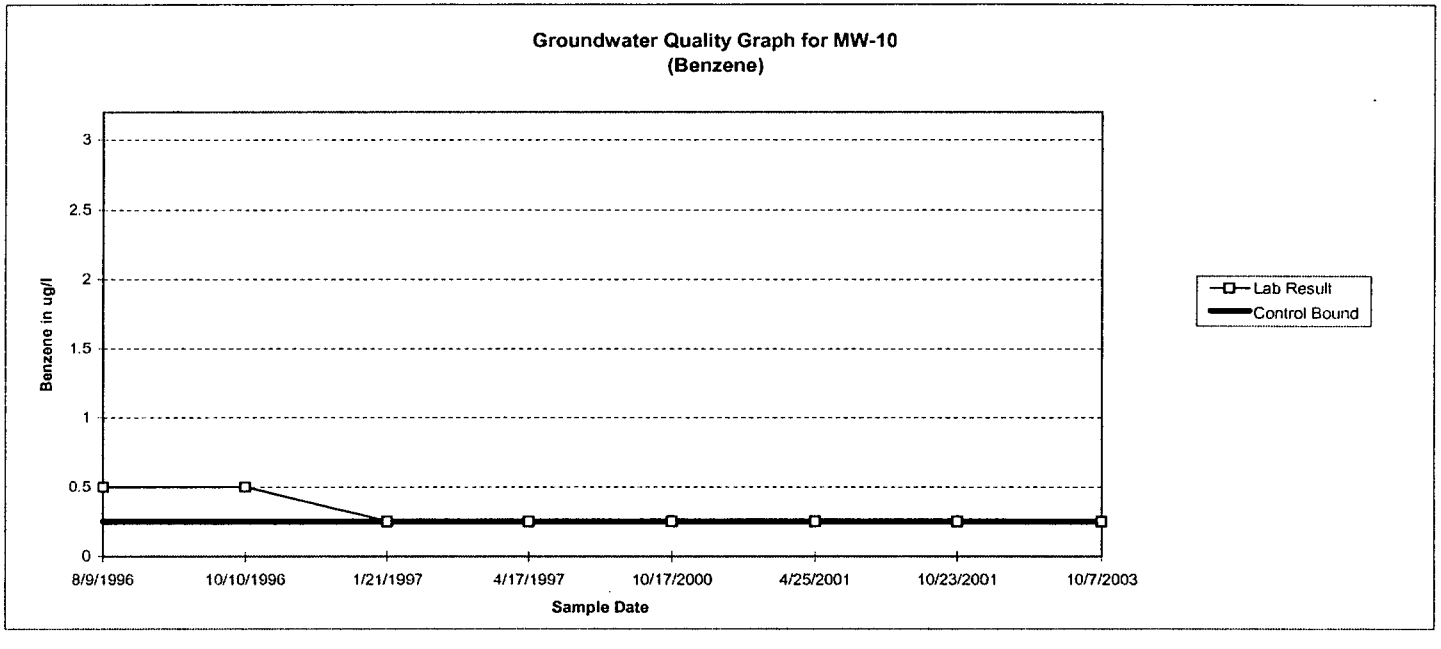


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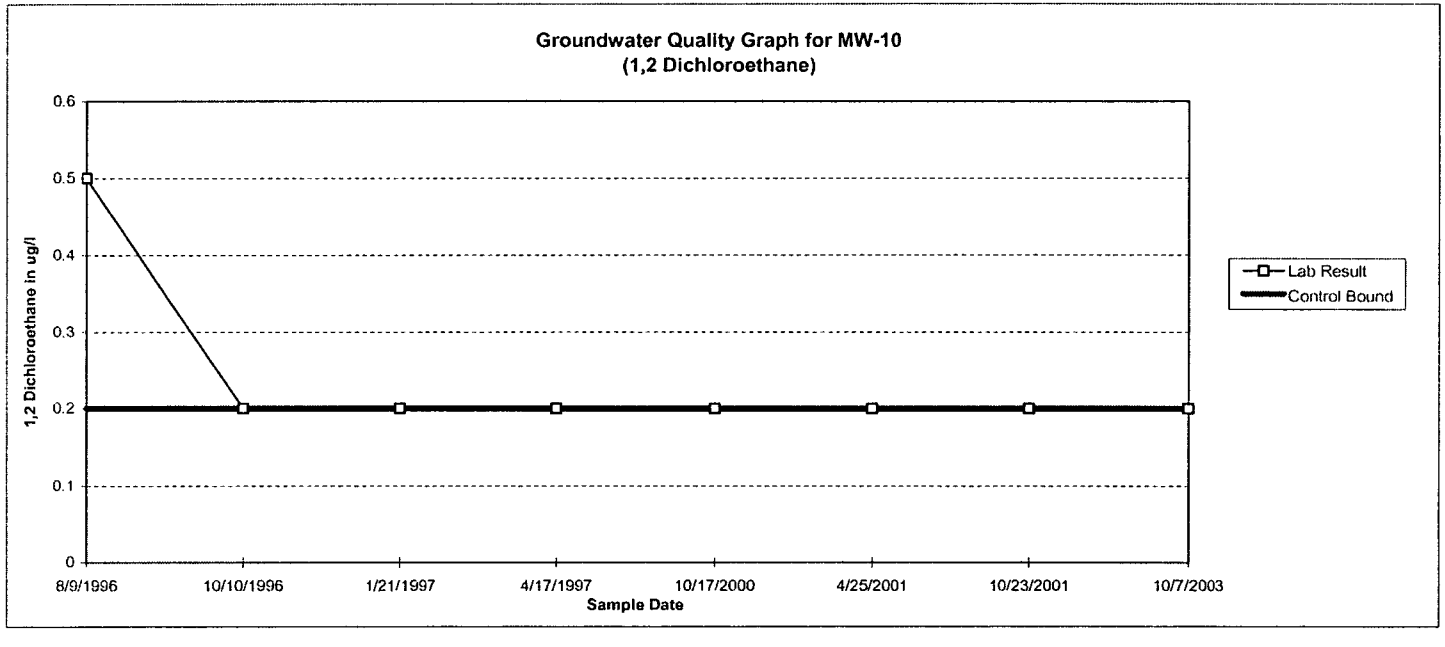


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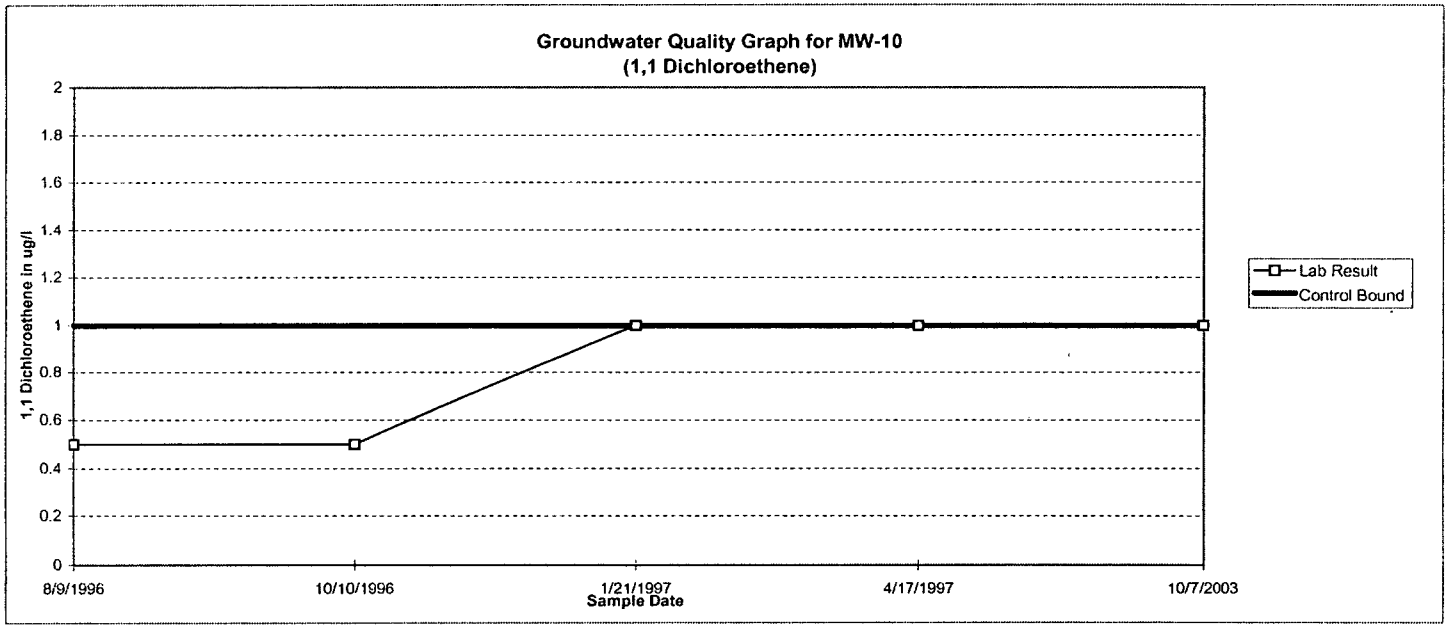


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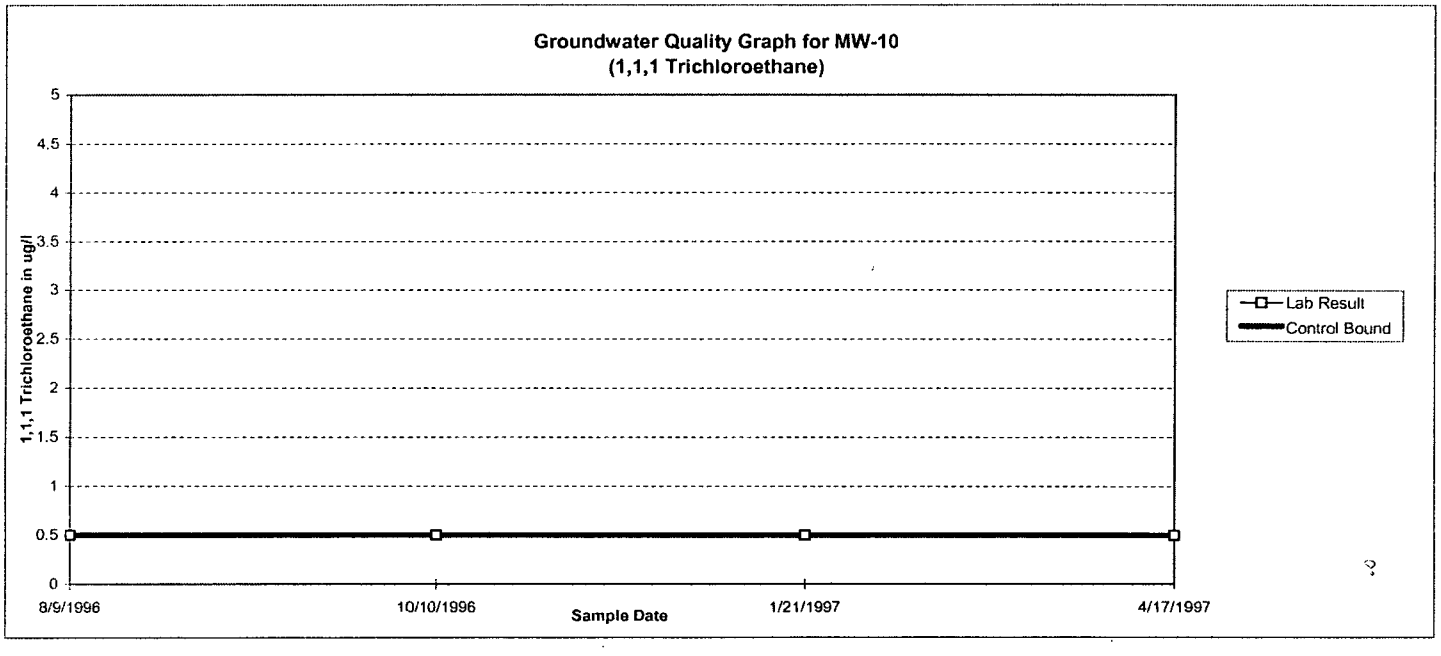


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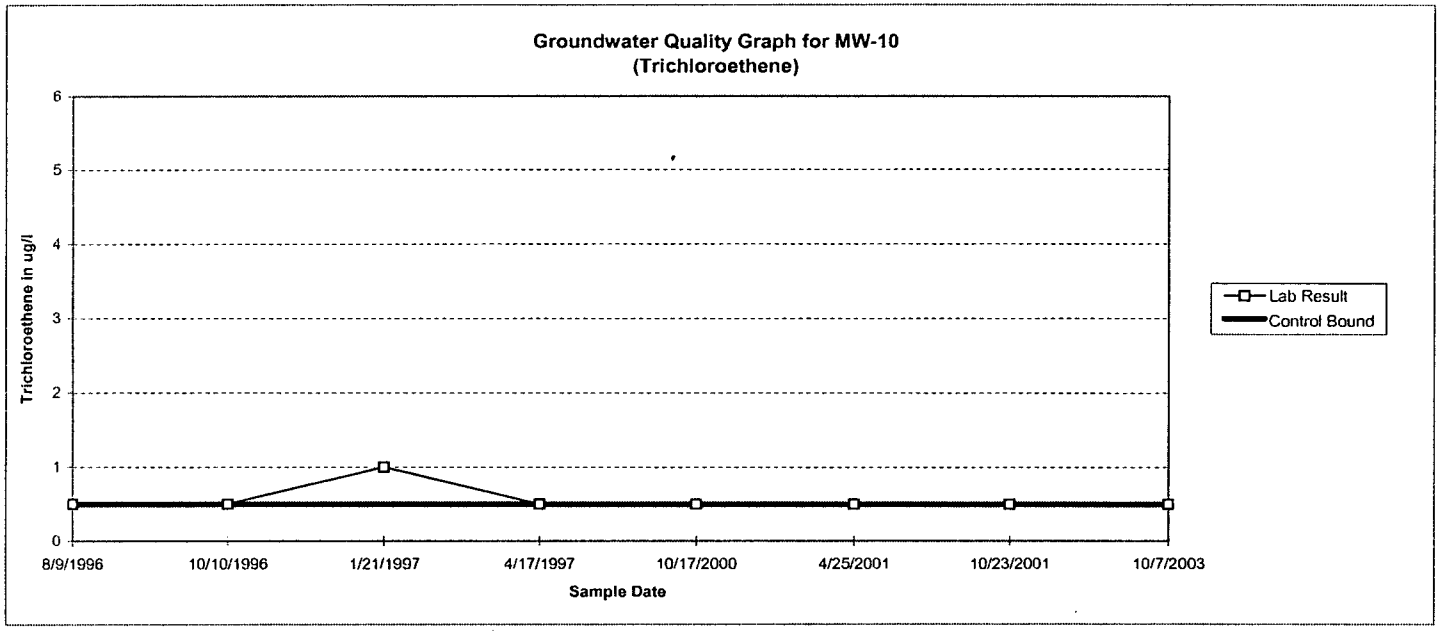


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## PROJECT NO. TERRACON 40905033

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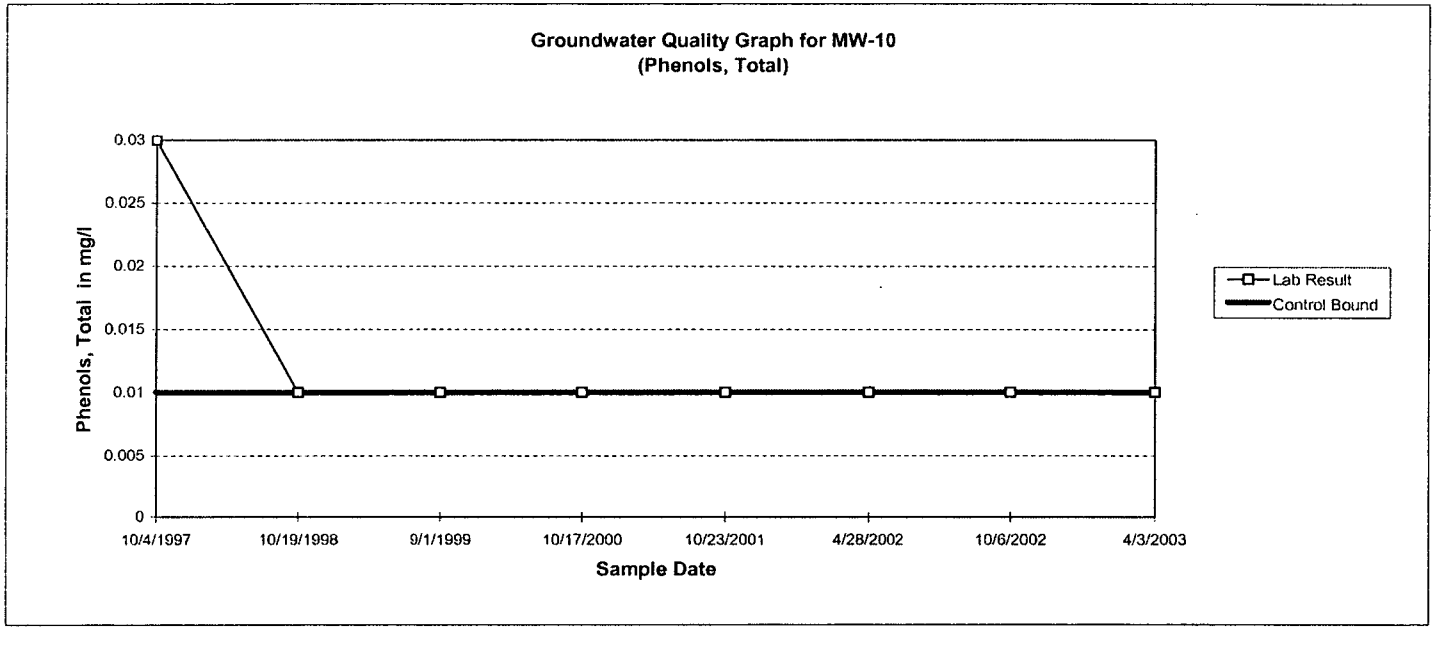
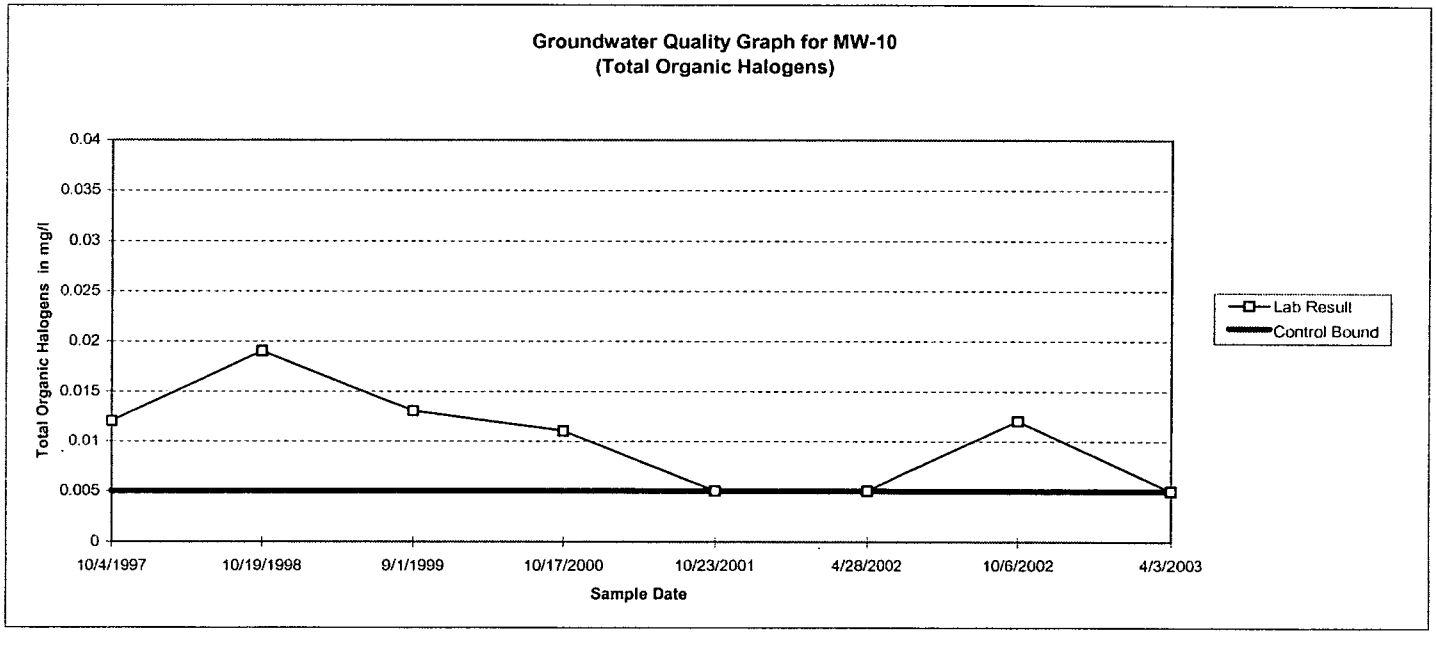



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

**ANALYSIS SHEET MW-10**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**PROJECT NO. TERRACON 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

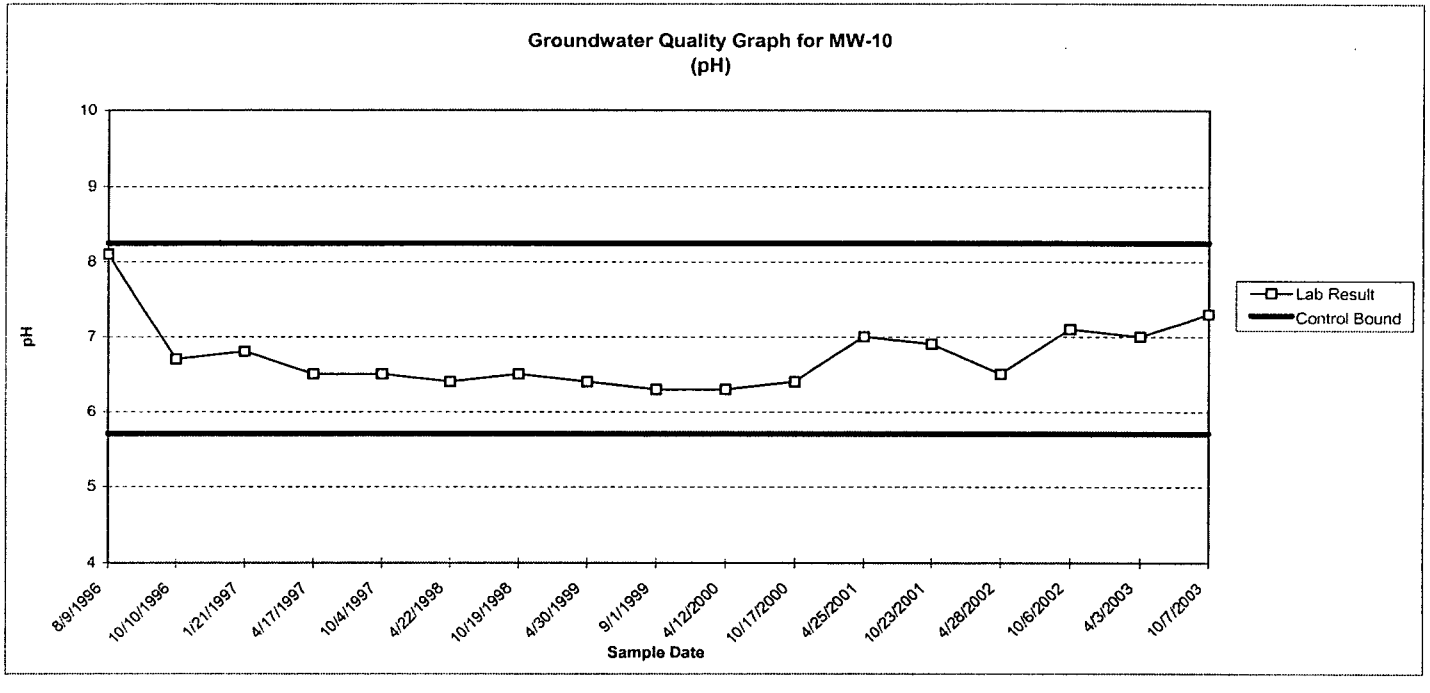



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

**ANALYSIS SHEET MW-10**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**PROJECT NO. TERRACON 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

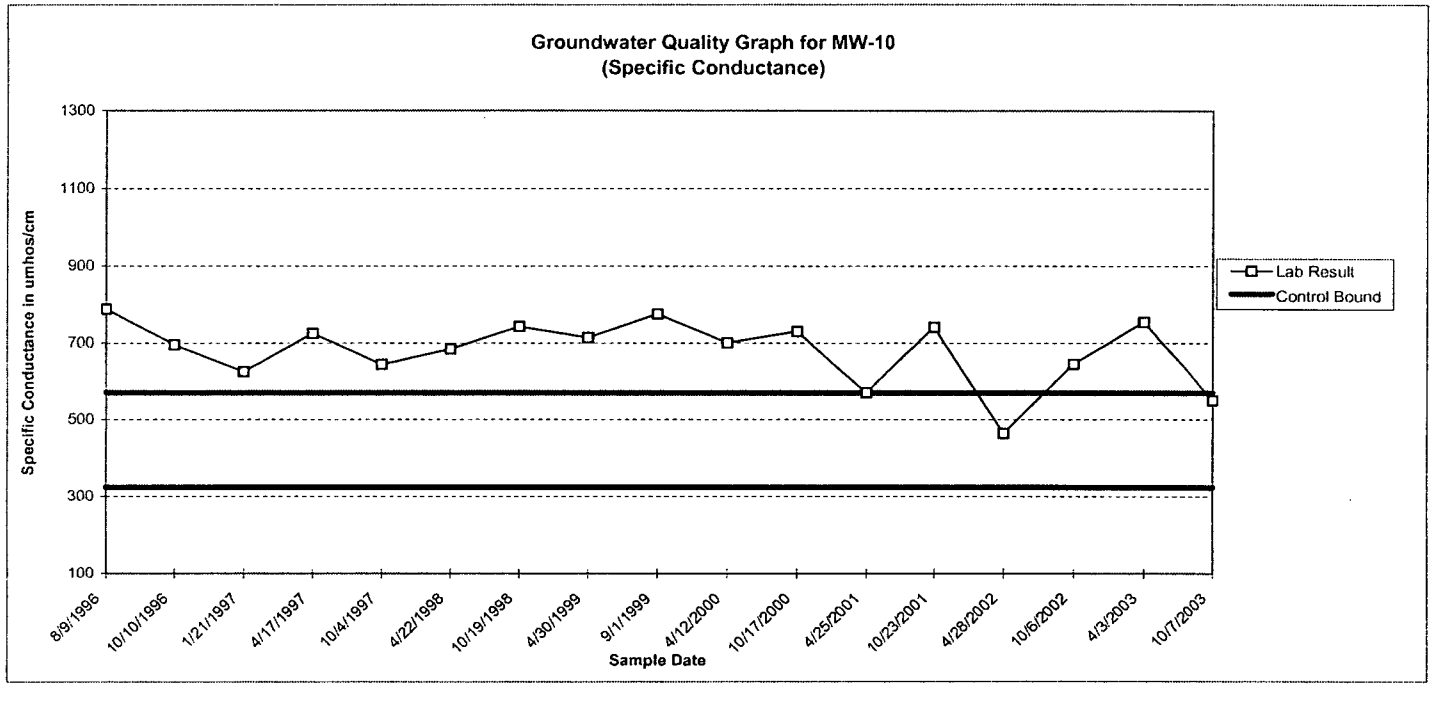



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

**ANALYSIS SHEET MW-10**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**PROJECT NO. TERRACON 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-9

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

*SAMPLE LOCATION NO.* *MW-9* *(Down-gradient)*

*ANALYSIS PERFORMED BY:* *TestAmerica Laboratories* *SAMPLED BY:* *Plymouth County Landfill Personnel*

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-9 Standard Deviation | MW-9 Mean | 10/10/1996 | 1/21/1997 | 4/17/1997 | 7/15/1997 | 10/4/1997 | 4/22/1998 | 10/19/1998 | 4/30/1999 | 9/1/1999 | 4/12/2000 | 10/17/2000 |
| **Laboratory Parameters** | | | | | | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 1.001 | 10.522 | 8.7 | 10 | 11 | 12 | 11 | 11.3 | 11 | 9.7 | 10 | - | - |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 1.233 | 2.911 | **2.5** | 6.2 | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | - | - |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.100 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | - | - |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.000 | 0.050 | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | - | - |
| Benzene (µg/l) | 0.250 | 0.250 | 0.083 | 0.278 | **0.5** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | **0.25** | - | - |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.159 | 0.329 | 0.55 | **0.2** | **0.2** | **0.2** | 0.54 | **0.2** | 0.4 | 0.47 | **0.2** | - | - |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.177 | 0.938 | **0.5** | **1.0** | **1.0** | **1.0** | **1.0** | **1.0** | **1.0** | - | **1.0** | - | - |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.000 | 0.500 | **0.5** | **0.5** | **0.5** | **0.5** | - | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.000 | 0.500 | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | **0.5** | - | - |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.006 | 0.014 | - | - | - | - | 0.021 | - | **0.01** | - | **0.01** | - | - |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.011 | 0.017 | - | - | - | - | 0.018 | - | **0.005** | - | 0.027 | - | - |
| **Field Parameters** | | | | | | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.2 | 6.3 | 6.5 | 6.5 | 6 | 6.3 | 6.3 | 6.3 | 6.3 | 6.1 | 6.1 | - | - |
| Specific Conductance (umhos/cm) | 570 | 323 | 64 | 913 | 895 | 787 | 882 | 922 | 887 | 900 | 956 | 992 | 992 | - | - |

**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-9

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

*SAMPLE LOCATION NO.* *MW-9* *(Down-gradient)*

*ANALYSIS PERFORMED BY:* *TestAmerica Laboratories* *SAMPLED BY:* *Plymouth County Landfill Personnel*

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-9 Standard Deviation | MW-9 Mean | 4/25/2001 | 10/23/2001 | 4/28/2002 | 10/6/2002 | 4/3/2003 | 10/7/2003 |
| **Laboratory Parameters** | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 1.001 | 10.522 | - | - | - | - | - | - |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 1.233 | 2.911 | - | - | - | - | - | - |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.100 | - | - | - | - | - | - |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.000 | 0.050 | - | - | - | - | - | - |
| Benzene (µg/l) | 0.250 | 0.250 | 0.083 | 0.278 | - | - | - | - | - | - |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.159 | 0.329 | - | - | - | - | - | - |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.177 | 0.938 | - | - | - | - | - | - |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.000 | 0.500 | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 0.000 | 0.500 | - | - | - | - | - | - |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.006 | 0.014 | - | - | - | - | - | - |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.011 | 0.017 | - | - | - | - | - | - |
| **Field Parameters** | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.2 | 6.3 | - | - | - | - | - | - |
| Specific Conductance (umhos/cm) | 570 | 323 | 64 | 913 | - | - | - | - | - | - |

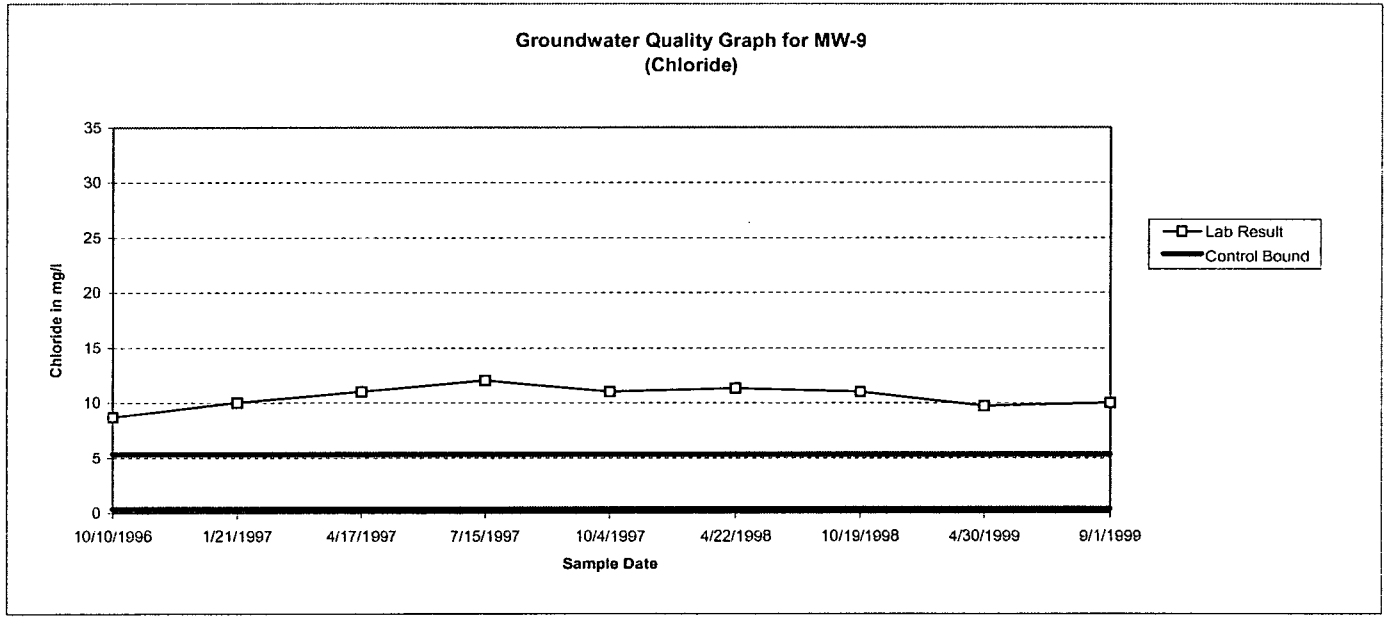
NOTE:

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-9

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

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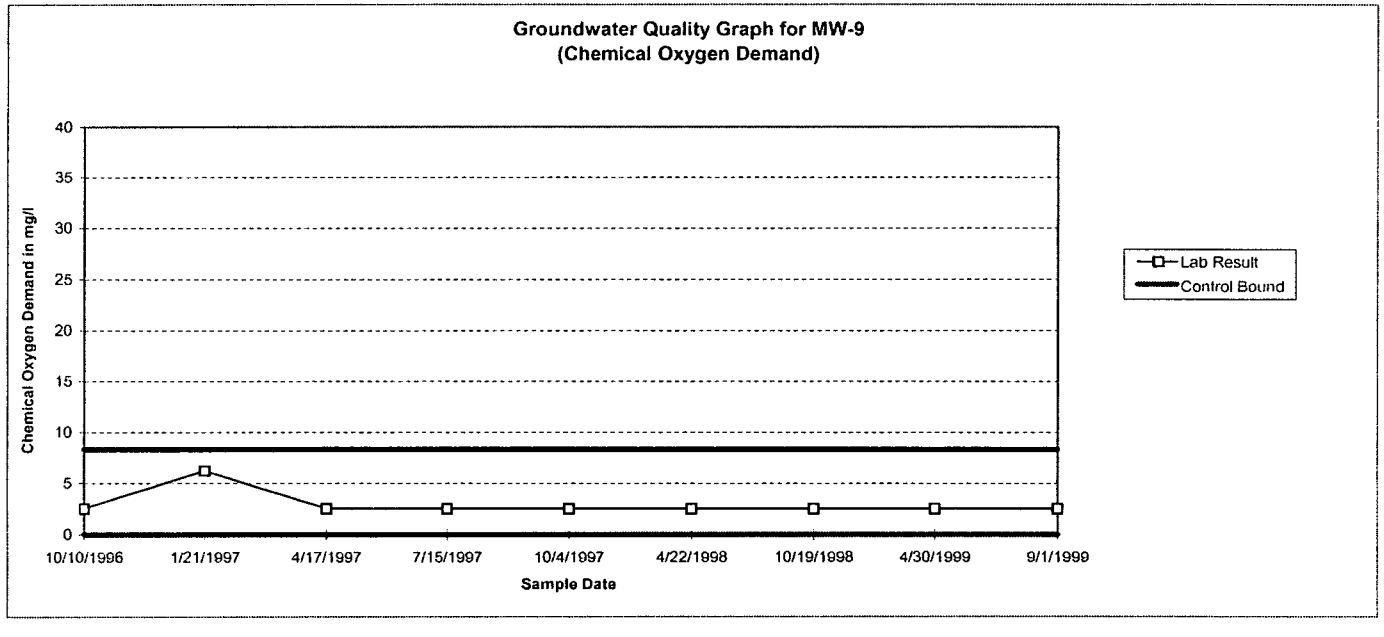
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-9

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
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## ANALYSIS SHEET MW-9

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

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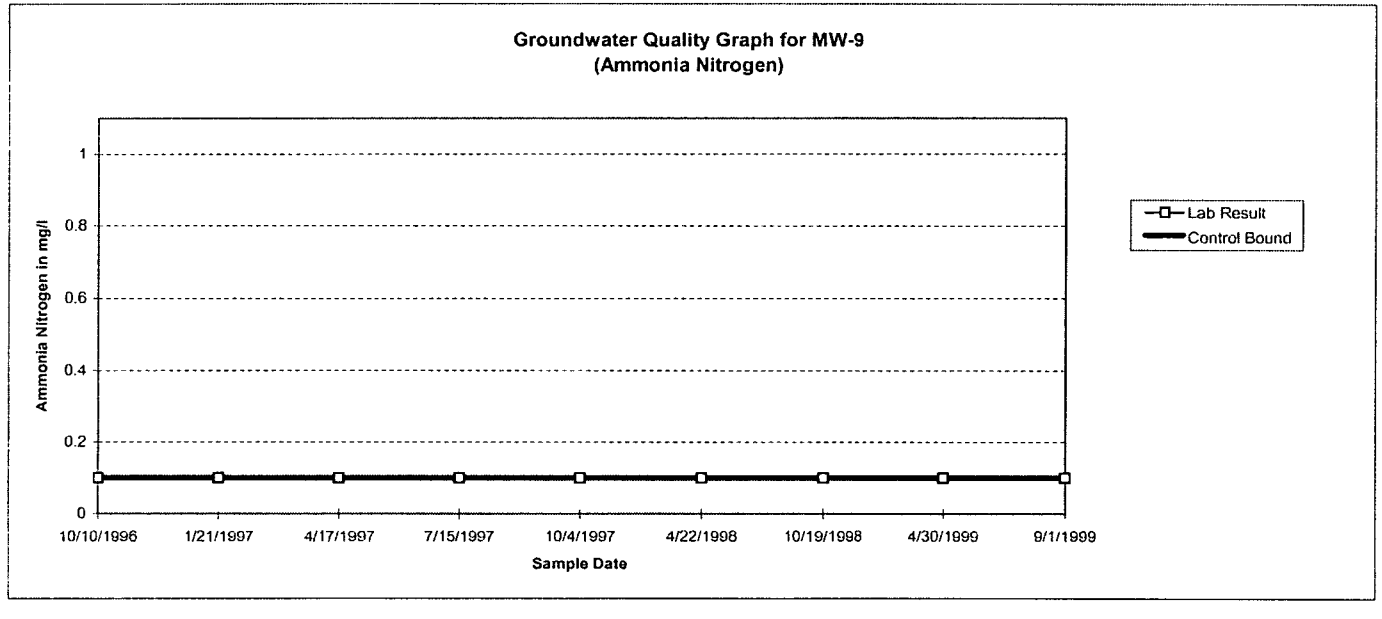


NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-9

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
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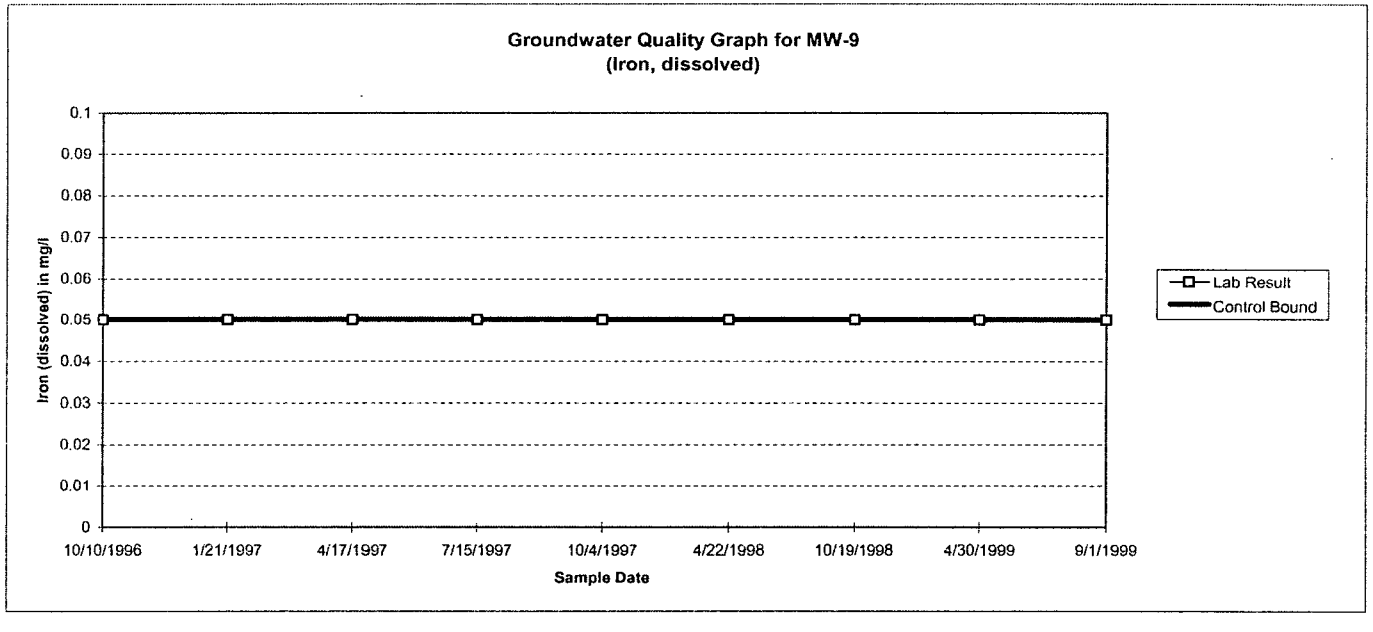


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## ANALYSIS SHEET MW-9

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

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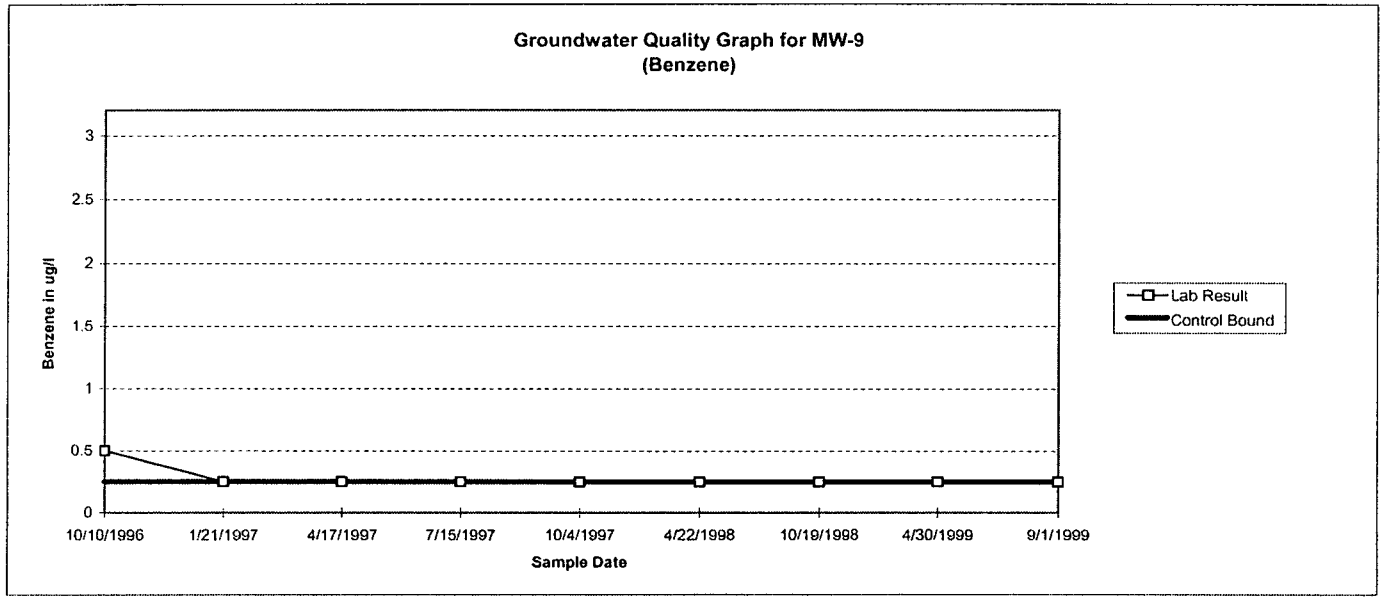


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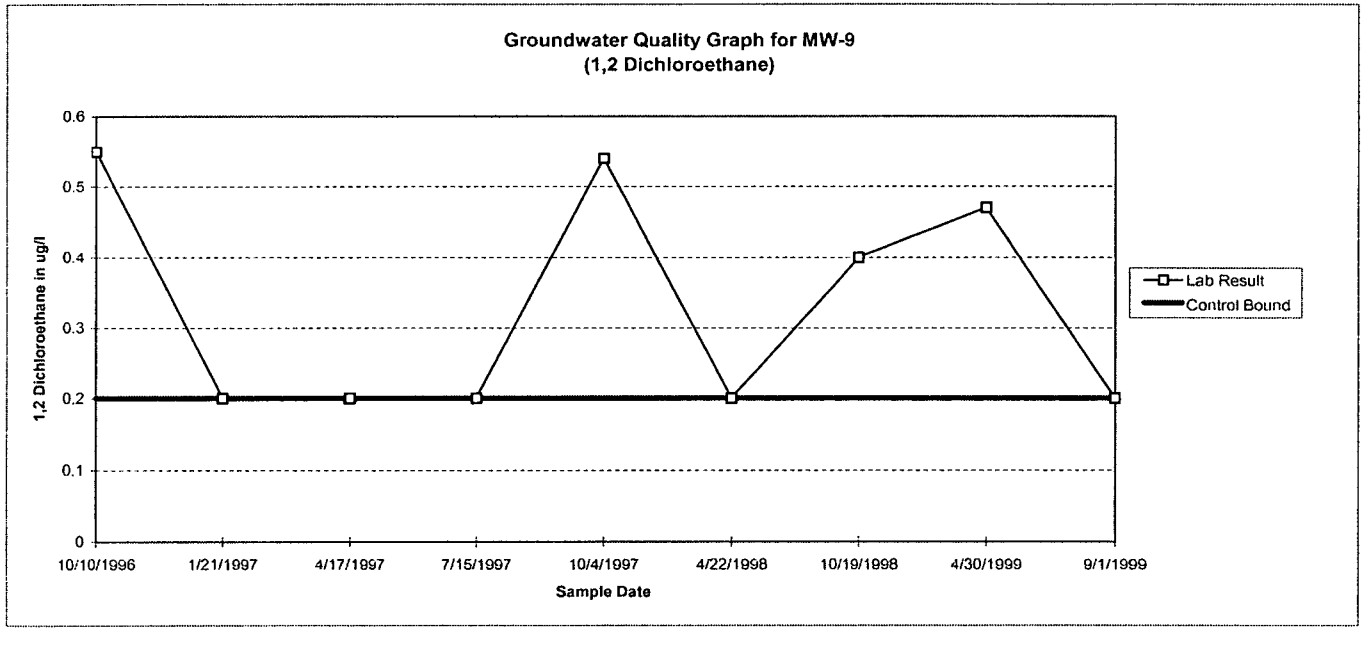
**ANALYSIS SHEET MW-9**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**TERRACON PROJECT NO. 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**




NOTE:
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## ANALYSIS SHEET MW-9

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

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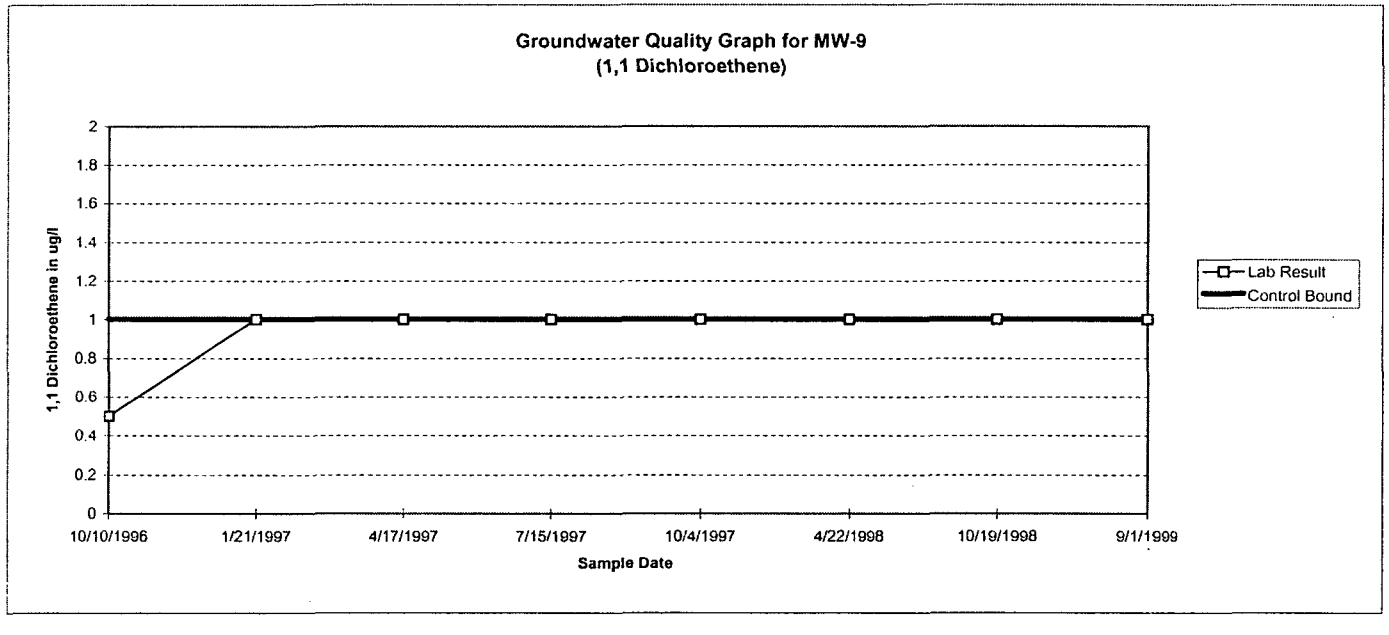


NOTE:
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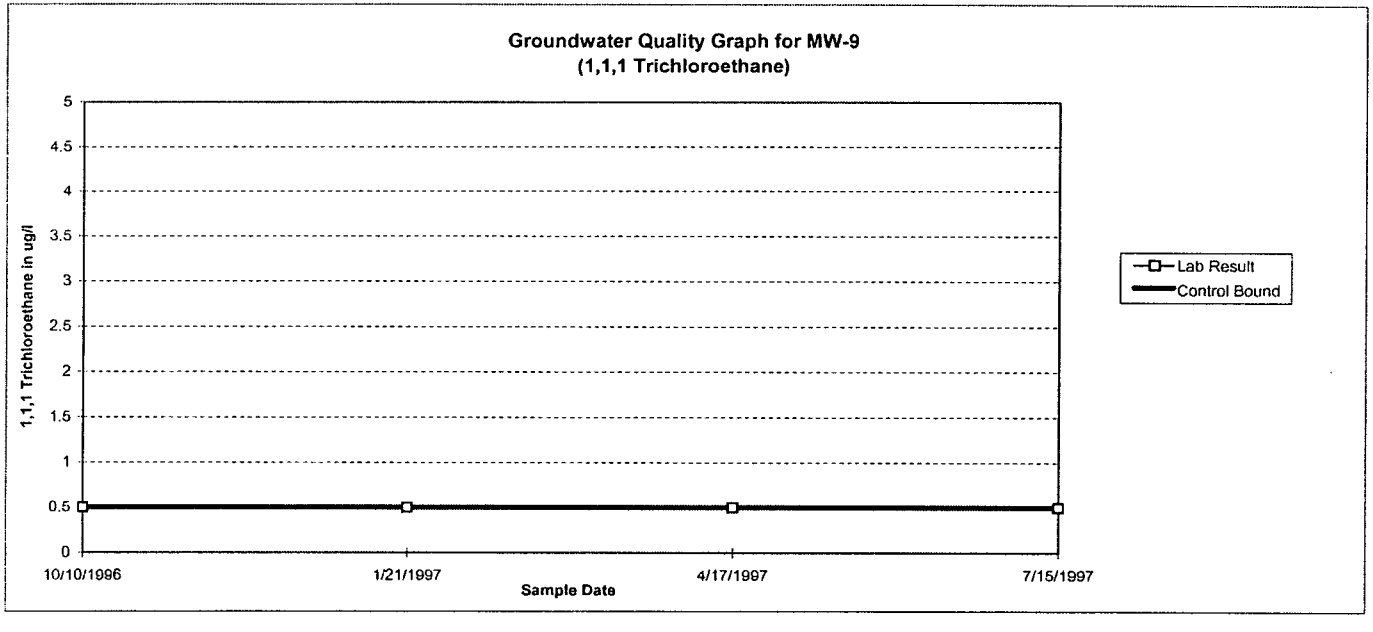
## ANALYSIS SHEET MW-9

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

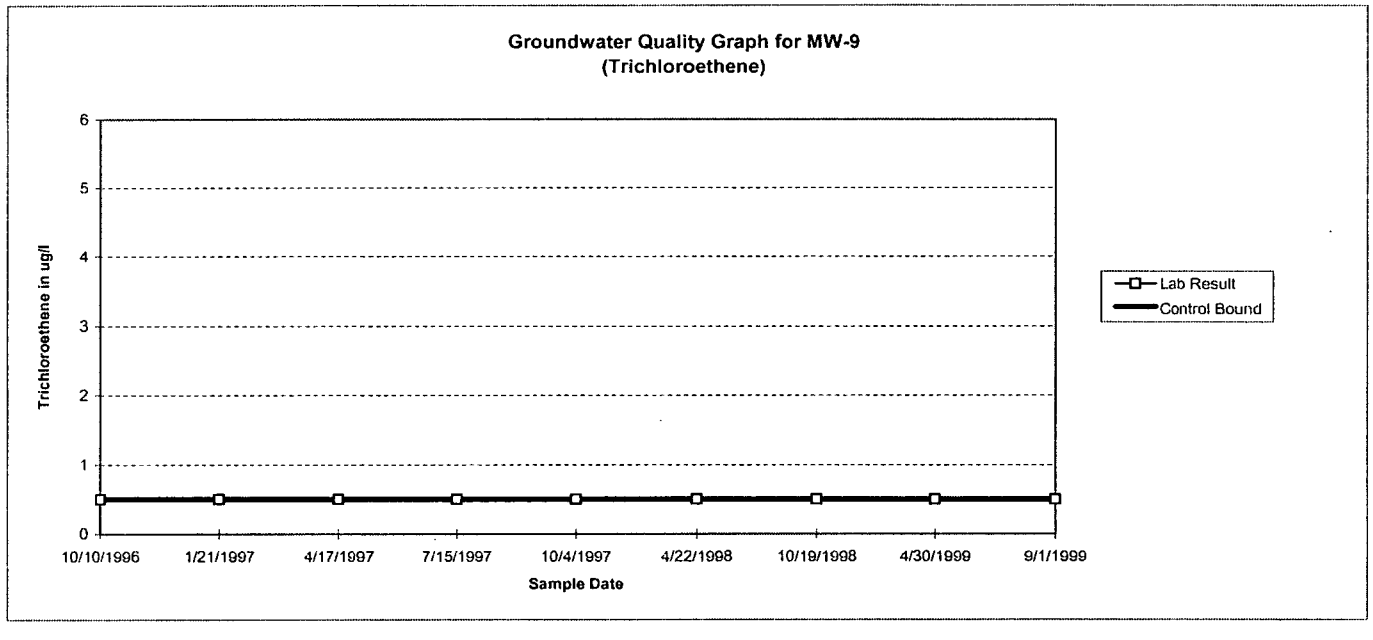



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-9

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
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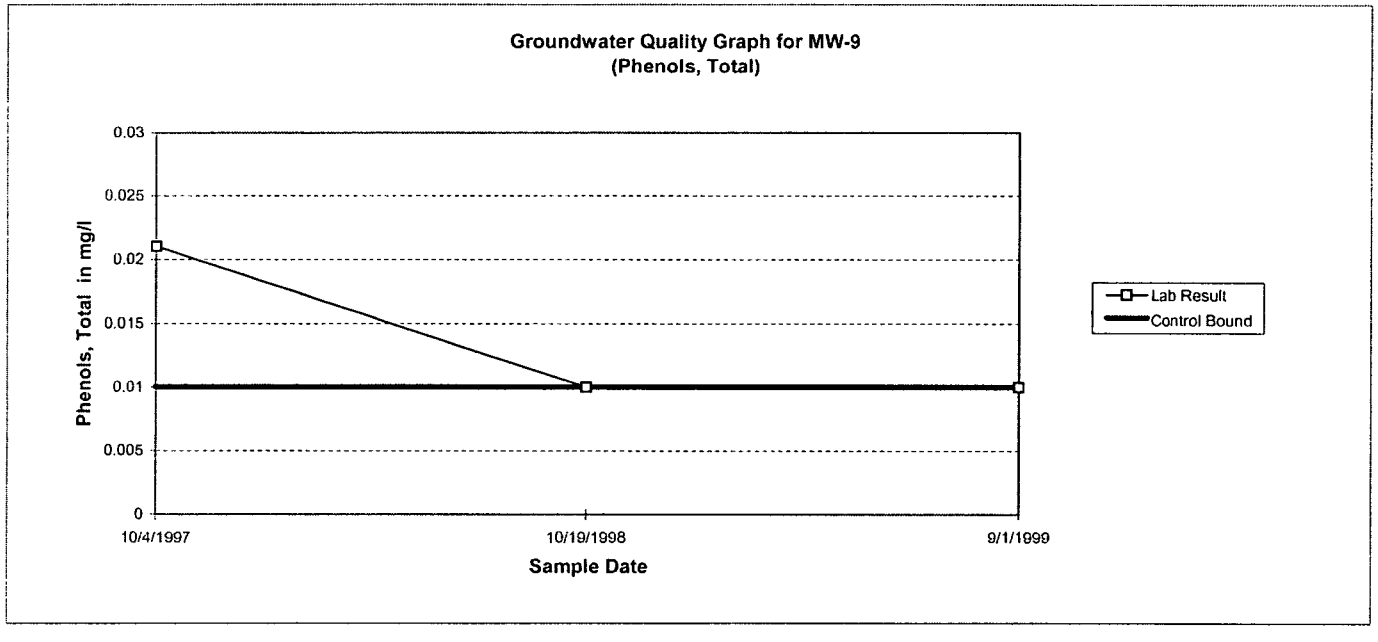
**ANALYSIS SHEET MW-9**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**TERRACON PROJECT NO. 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

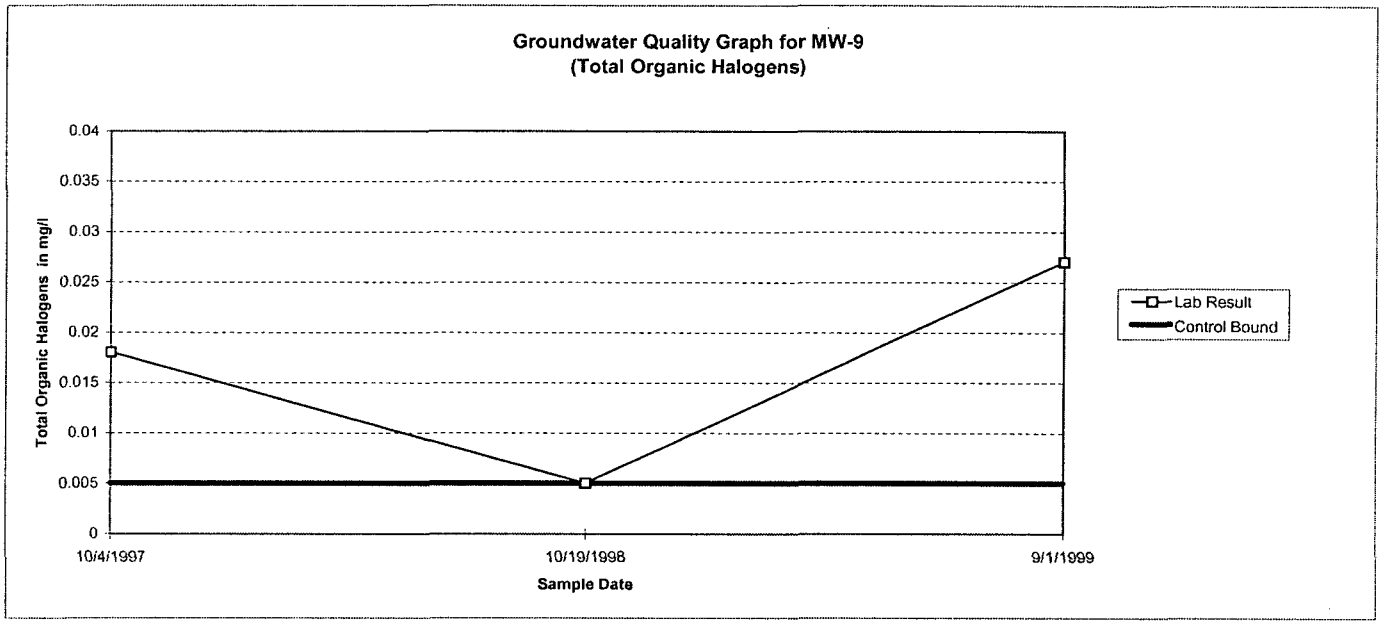



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-9

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

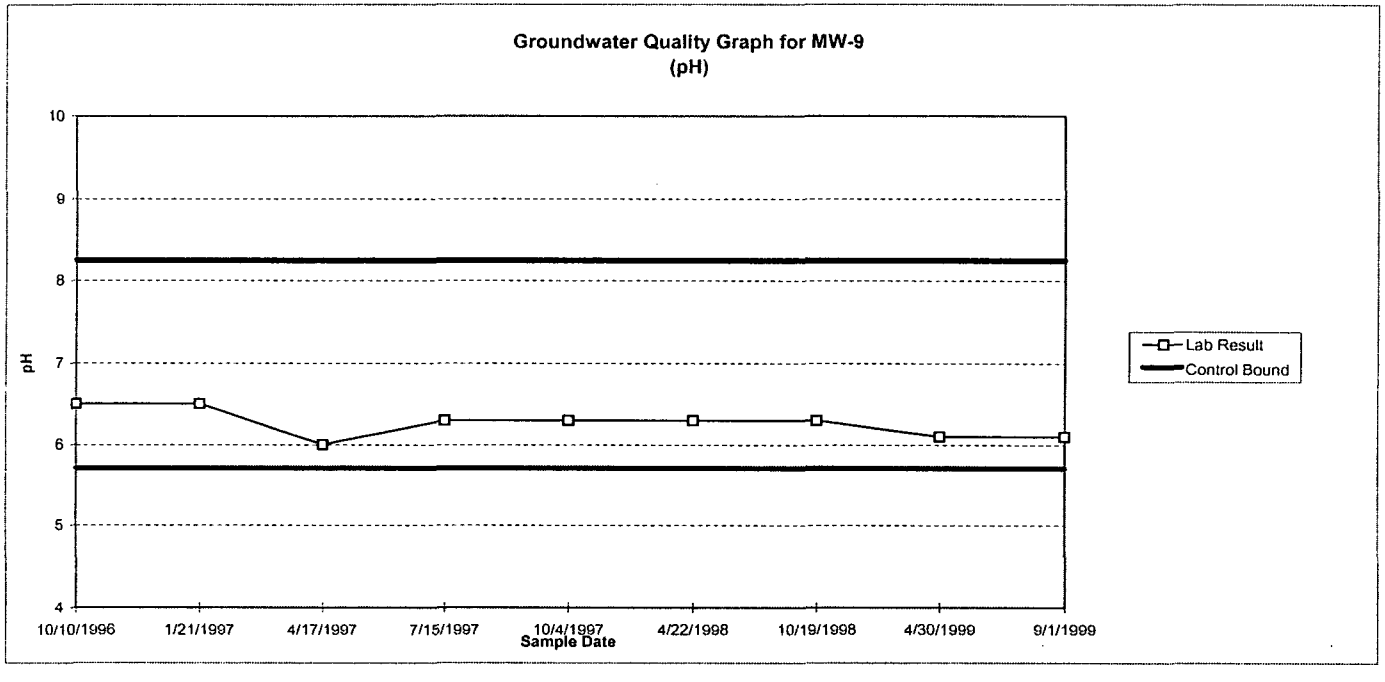



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-9

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET



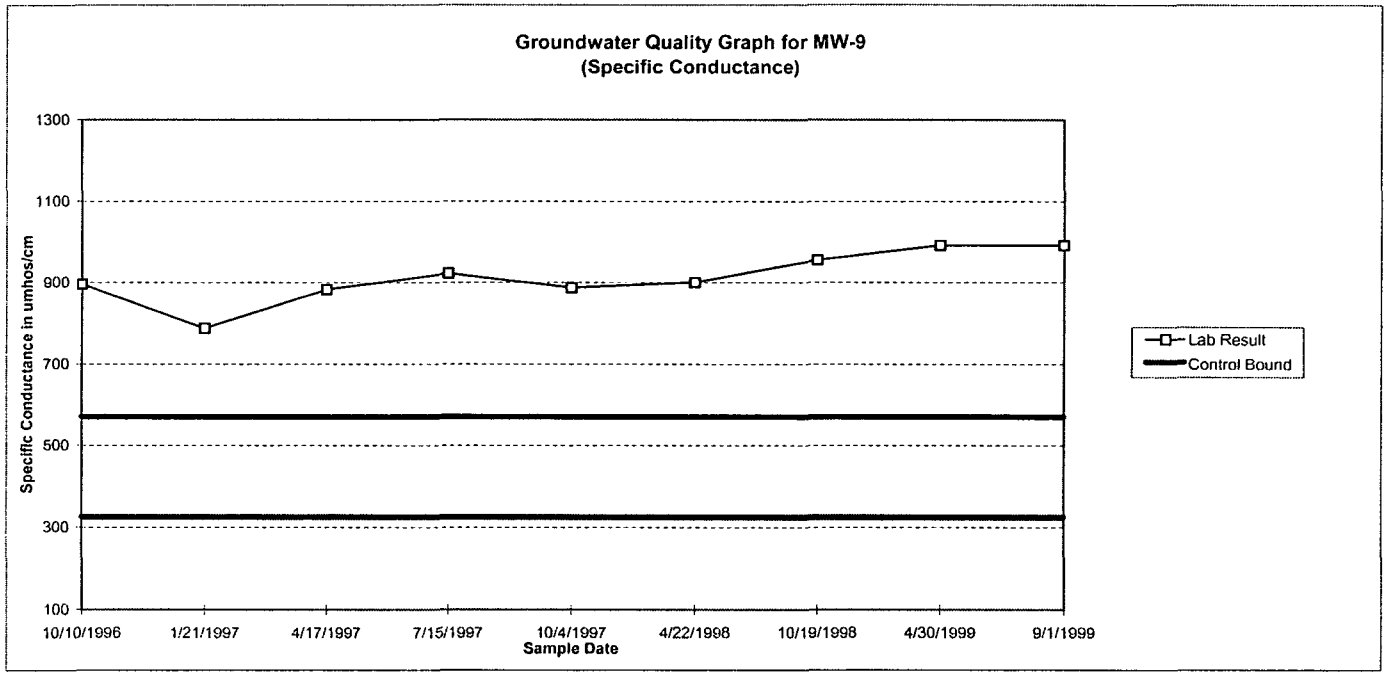

NOTE:

1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-9

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## TERRACON PROJECT NO. 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-8

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

*SAMPLE LOCATION NO.* *MW-8* *(Down-gradient)*

*ANALYSIS PERFORMED BY:* *TestAmerica Laboratories* *SAMPLED BY:* *Plymouth County Landfill Personnel*

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-8 Standard Deviation | MW-8 Mean | 10/11/1996 | 1/21/1997 | 4/17/1997 | 7/15/1997 | 10/4/1997 | 4/22/1998 | 10/19/1998 | 4/30/1999 | 9/1/1999 | 4/12/2000 | 10/17/2000 |
| **Laboratory Parameters** | | | | | | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 11.430 | 15.97 | 12 | 12 | 13 | 15 | 11 | 11 | 12 | 12 | 10 | 8.4 | 6.2 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 2.651 | 3.98 | **2.5** | 7.9 | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | 5.0 | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.10 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.078 | 0.09 | **0.05** | 0.13 | **0.05** | **0.05** | 0.18 | **0.05** | **0.05** | **0.05** | 0.33 | 0.19 | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.736 | 0.96 | 2.8 | 2.2 | **0.25** | 1.2 | 1.53 | 1.1 | 1.3 | 1.3 | 1.0 | 0.72 | 0.95 |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.943 | 2.27 | 3 | 2.8 | **0.2** | 2.8 | 2.8 | 3.3 | 2.6 | 3.4 | 2.3 | 3.0 | 2.1 |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 3.661 | 2.02 | 14.2 | **1.0** | **1.0** | **1.0** | **1.0** | **1.0** | **1.0** | - | **1.0** | **1.0** | - |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.000 | 0.50 | **0.5** | **0.5** | **0.5** | **0.5** | - | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 5.263 | 12.62 | 21.4 | 20.8 | 18.6 | 17.1 | 15.6 | 16.4 | 16.1 | 14.1 | 11.8 | 9.8 | 9.8 |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.004 | 0.01 | - | - | - | - | 0.022 | - | **0.01** | - | **0.01** | - | **0.01** |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.021 | 0.09 | - | - | - | - | 0.114 | - | 0.056 | - | 0.112 | - | 0.103 |
| **Field Parameters** | | | | | | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.4 | 6.4 | 6.6 | 6.4 | 6.2 | 6.3 | 6.2 | 6.3 | 6.2 | 6.1 | 5.9 | 5.8 | 6.2 |
| Specific Conductance (umhos/cm) | 570 | 323 | 132 | 946 | 923 | 823 | 896 | 929 | 888 | 945 | 1003 | 1050 | 1092 | 970 | 942 |

NOTE:

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-8

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

*SAMPLE LOCATION NO.* *MW-8* *(Down-gradient)*

*ANALYSIS PERFORMED BY:* *TestAmerica Laboratories* *SAMPLED BY:* *Plymouth County Landfill Personnel*

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-8 Standard Deviation | MW-8 Mean | 4/25/2001 | 10/23/2001 | 4/28/2002 | 10/6/2002 | 4/3/2003 | 10/7/2003 |
| **Laboratory Parameters** | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 11.430 | 15.97 | 9.4 | 21.6 | 55.4 | 26.7 | 14.2 | 21.6 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 2.651 | 3.98 | **2.5** | **2.5** | 5.6 | 11 | **2.5** | 8.2 |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.000 | 0.10 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.078 | 0.09 | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.736 | 0.96 | **0.25** | **0.25** | **0.25** | **0.25** | 0.8 | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 0.943 | 2.27 | 2.7 | 2.3 | 1.9 | 1.61 | **0.2** | 1.55 |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 3.661 | 2.02 | - | - | **1.0** | **1.0** | **1.0** | **1.0** |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.000 | 0.50 | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 5.263 | 12.62 | 7.8 | 7.3 | 6.4 | 7.0 | 9.5 | 5.02 |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.004 | 0.01 | - | **0.01** | **0.01** | **0.01** | **0.01** | - |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.021 | 0.09 | - | 0.075 | 0.077 | 0.072 | 0.074 | - |
| **Field Parameters** | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.4 | 6.4 | 6.8 | 6.8 | 6.5 | 7 | 6.8 | 7.1 |
| Specific Conductance (umhos/cm) | 570 | 323 | 132 | 946 | 1034 | 538 | 984 | 895 | 1060 | 1115 |

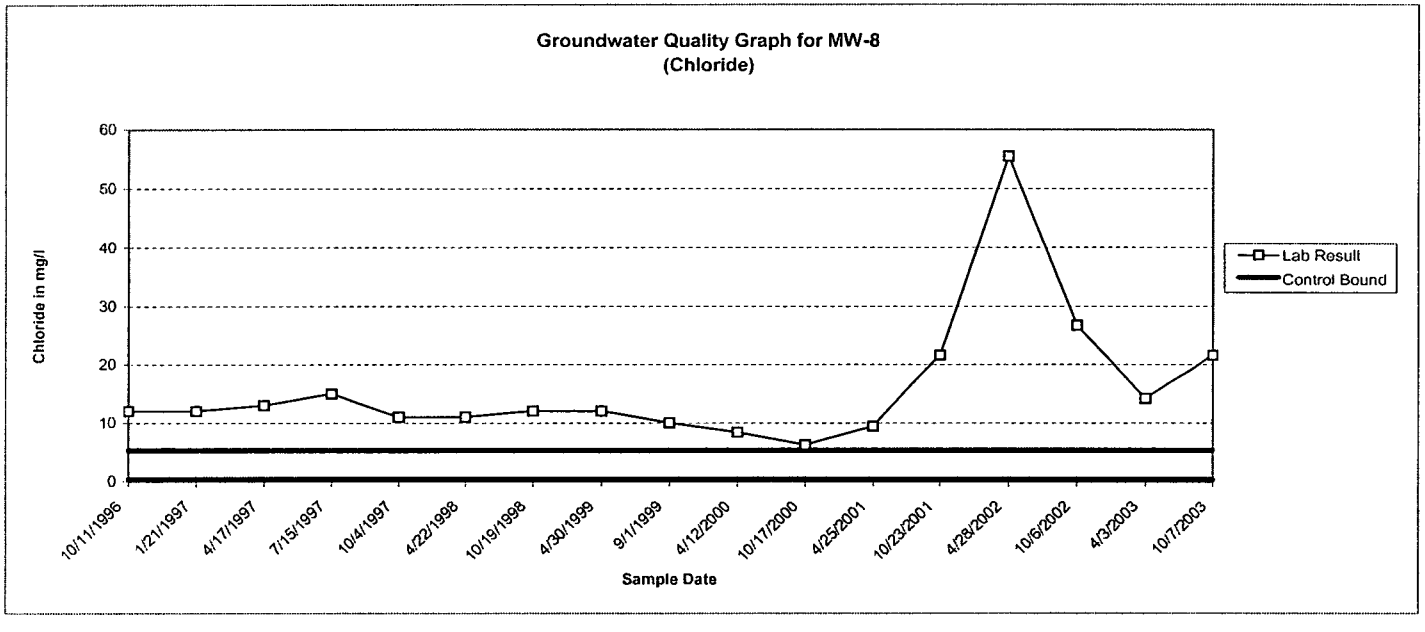
NOTE:

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

**ANALYSIS SHEET MW-8**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**PROJECT NO. TERRACON 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

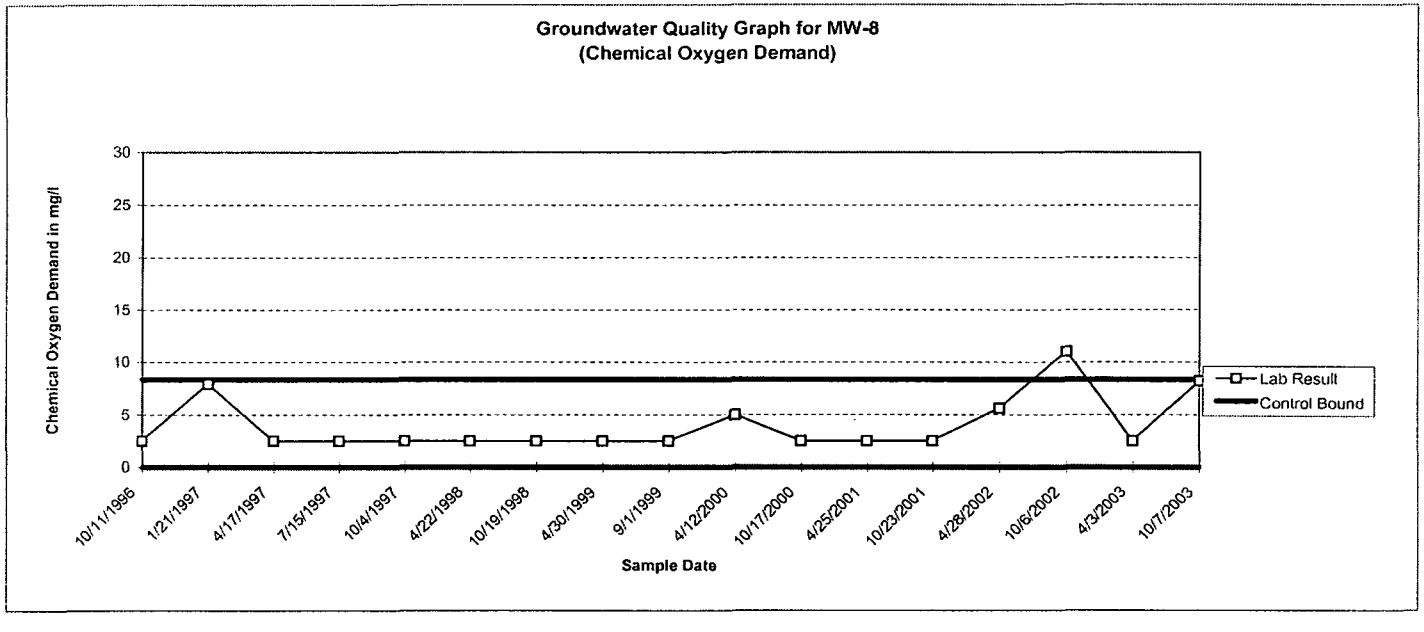



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

**ANALYSIS SHEET MW-8**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**PROJECT NO. TERRACON 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

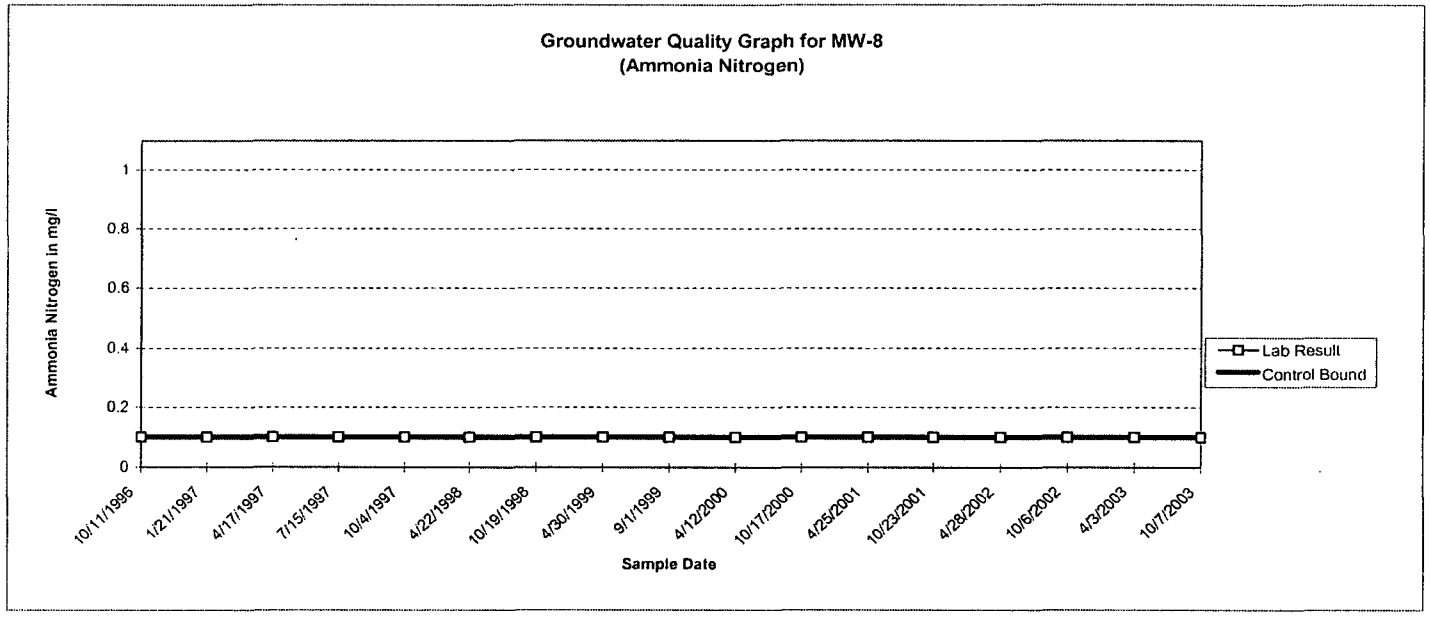



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-8

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

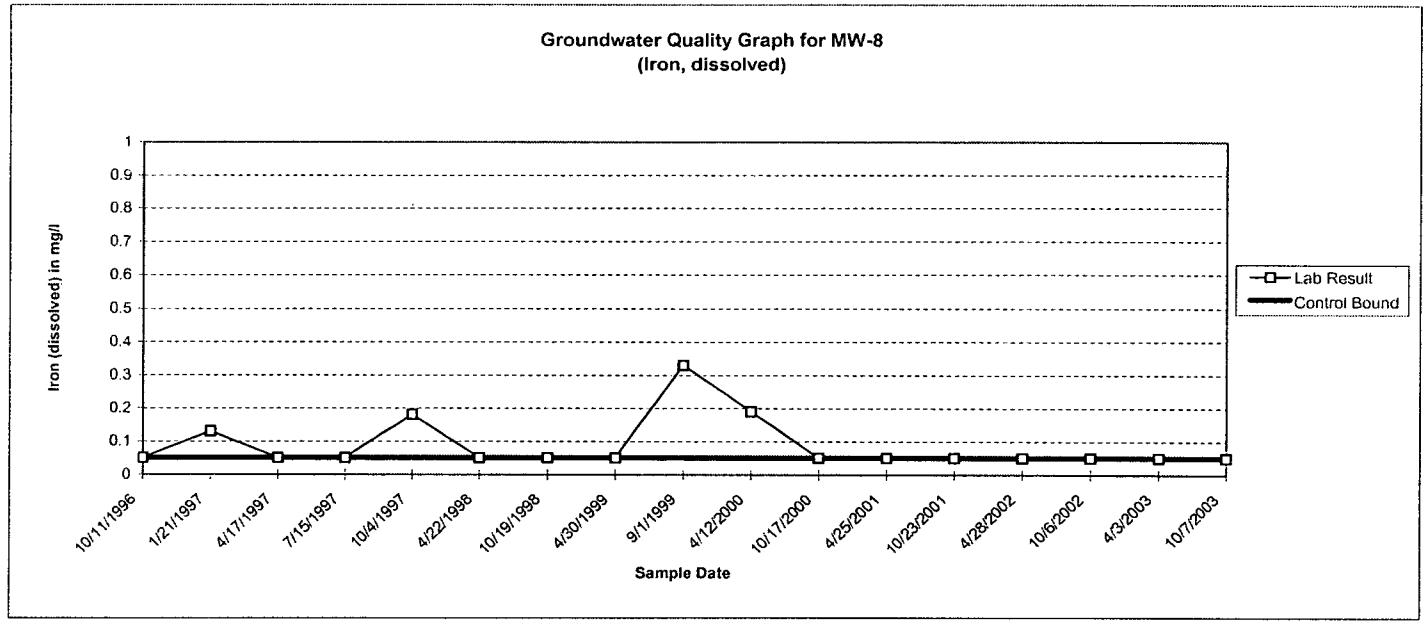



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-8

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET



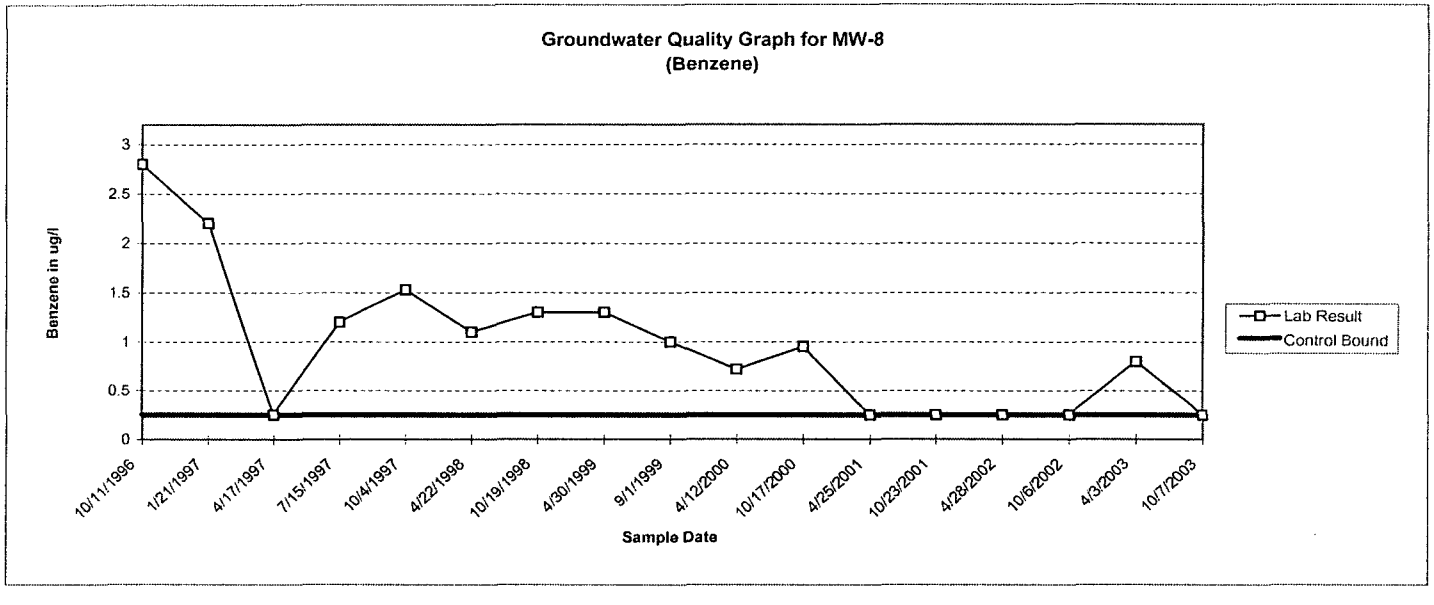

NOTE:

1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-8

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

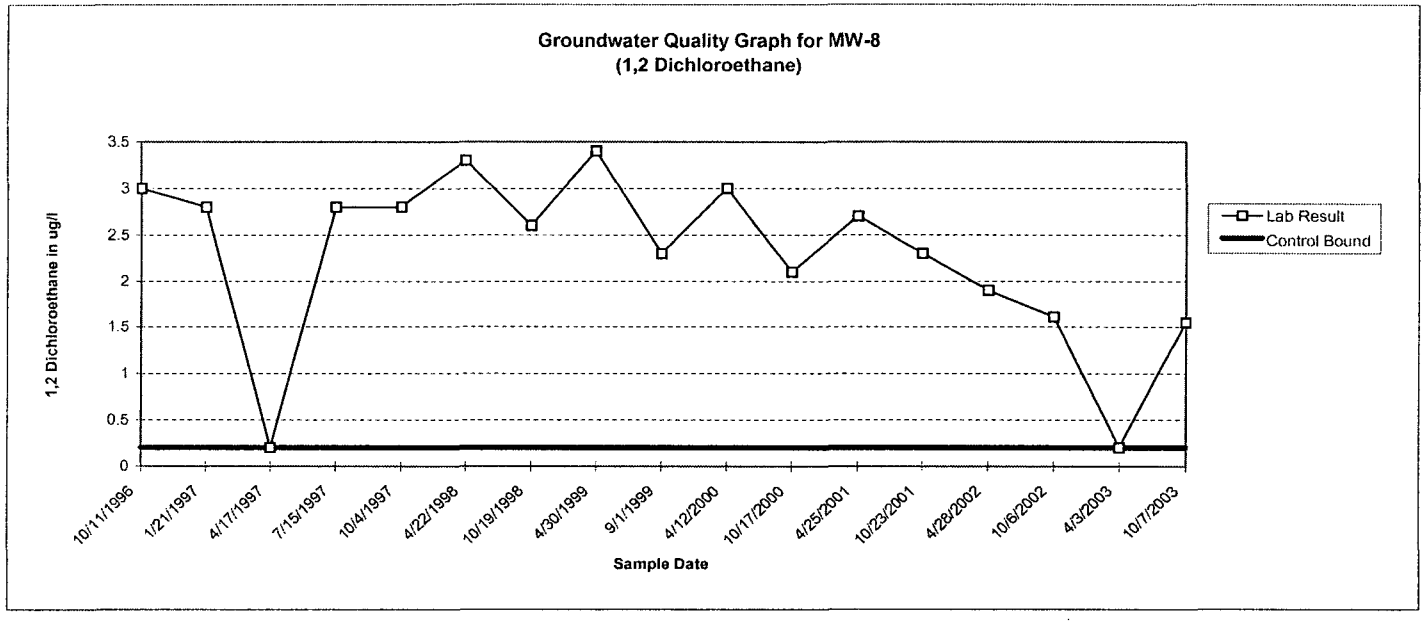



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-8

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

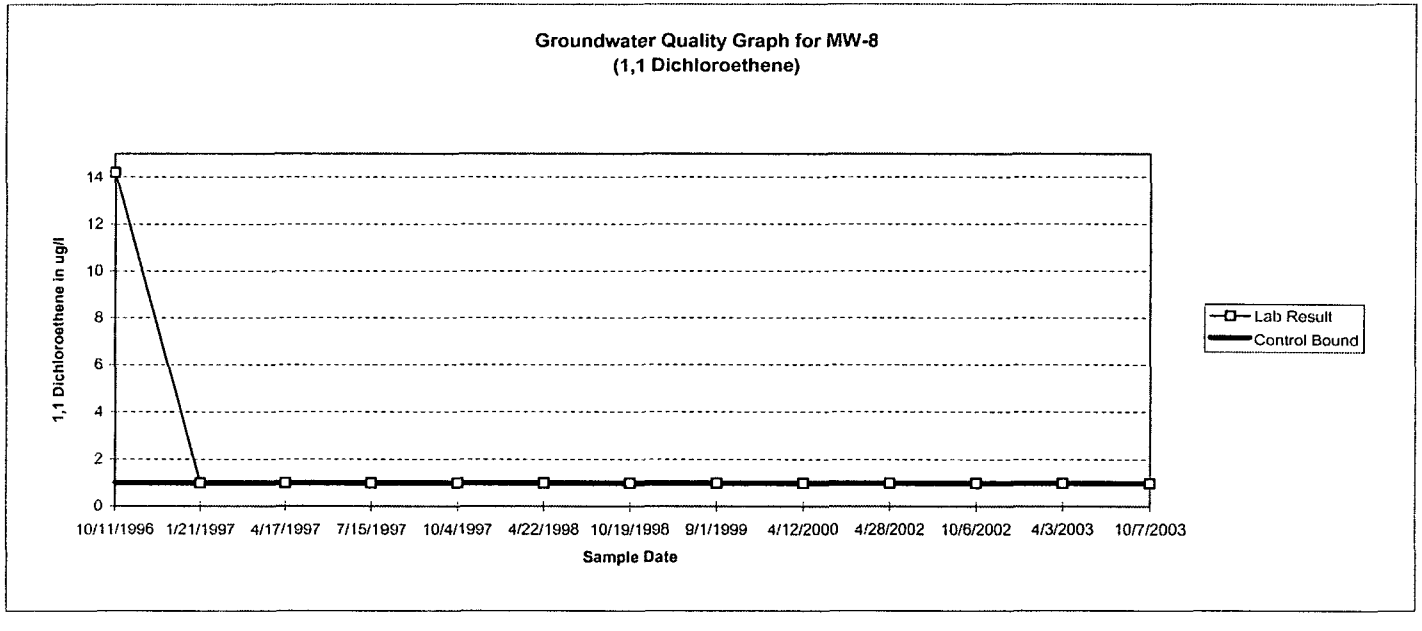



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-8

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

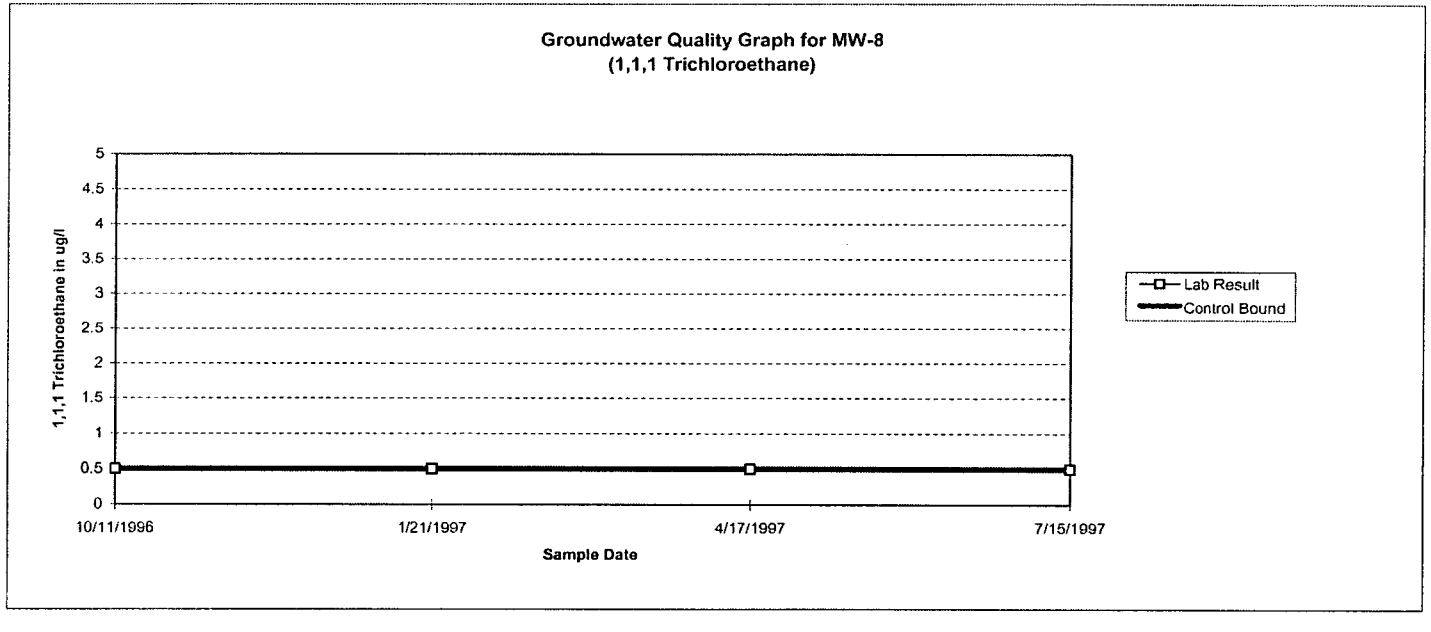



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-8

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

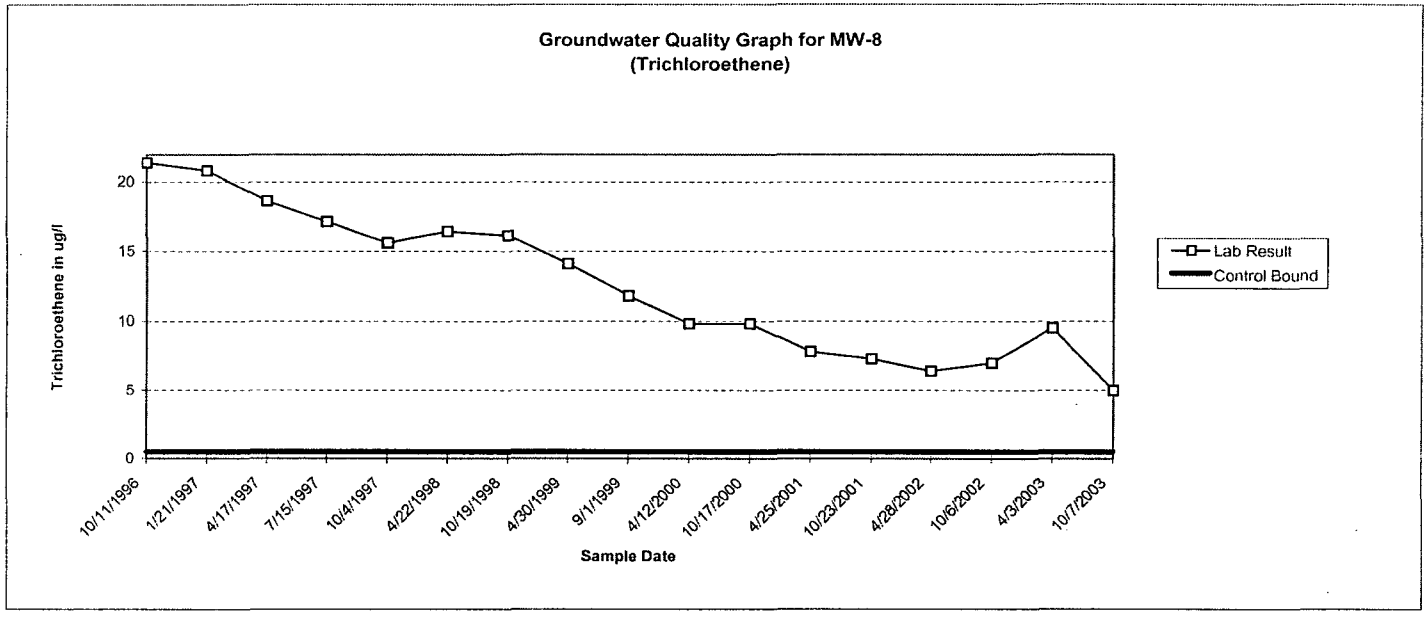



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-8

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

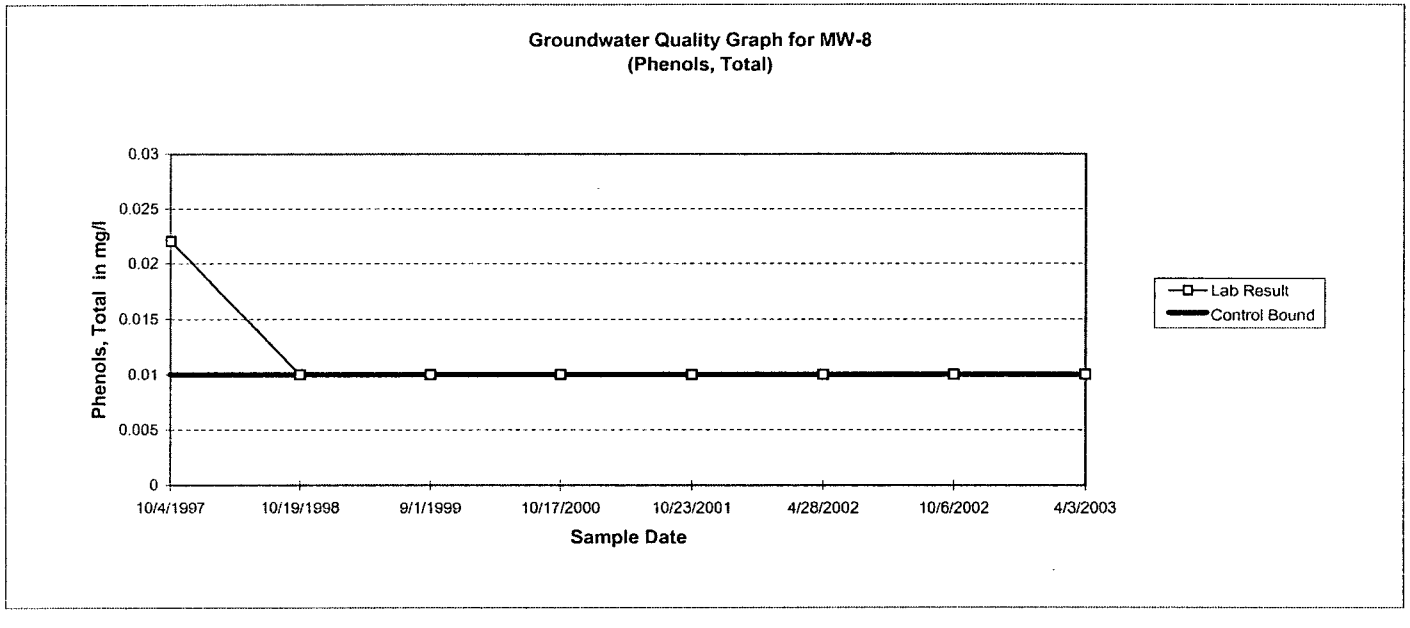



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).

## ANALYSIS SHEET MW-8

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

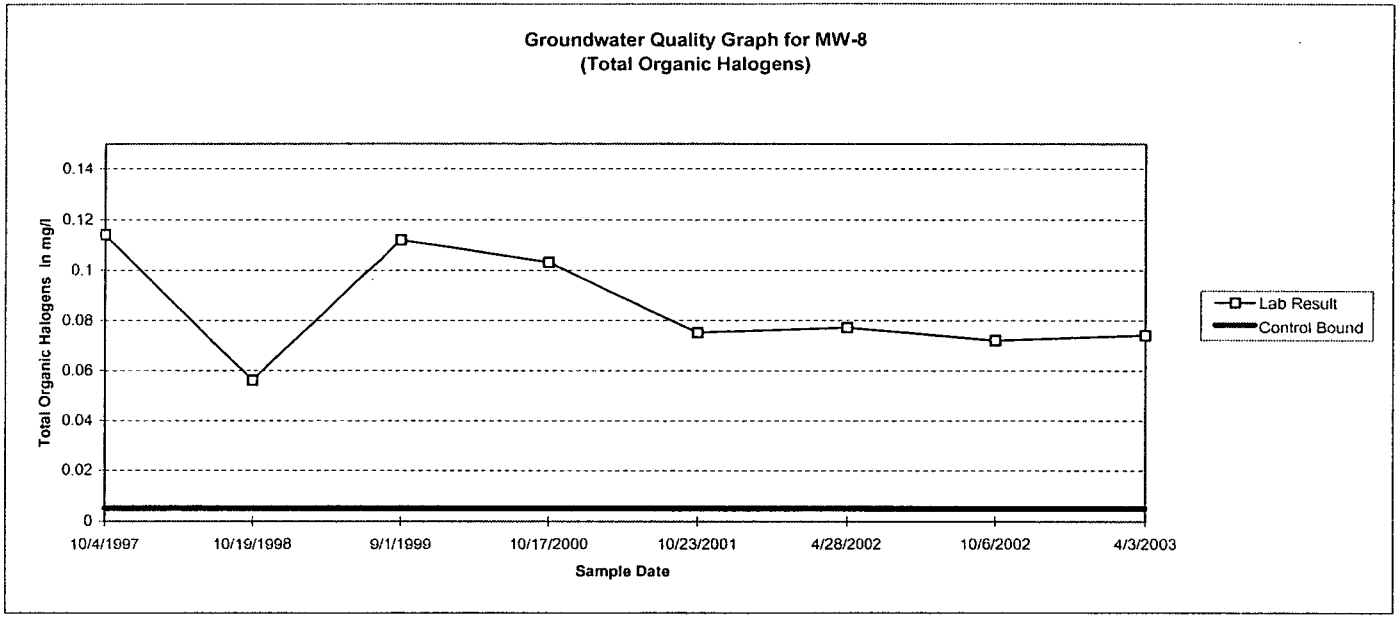



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

**ANALYSIS SHEET MW-8**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**PROJECT NO. TERRACON 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

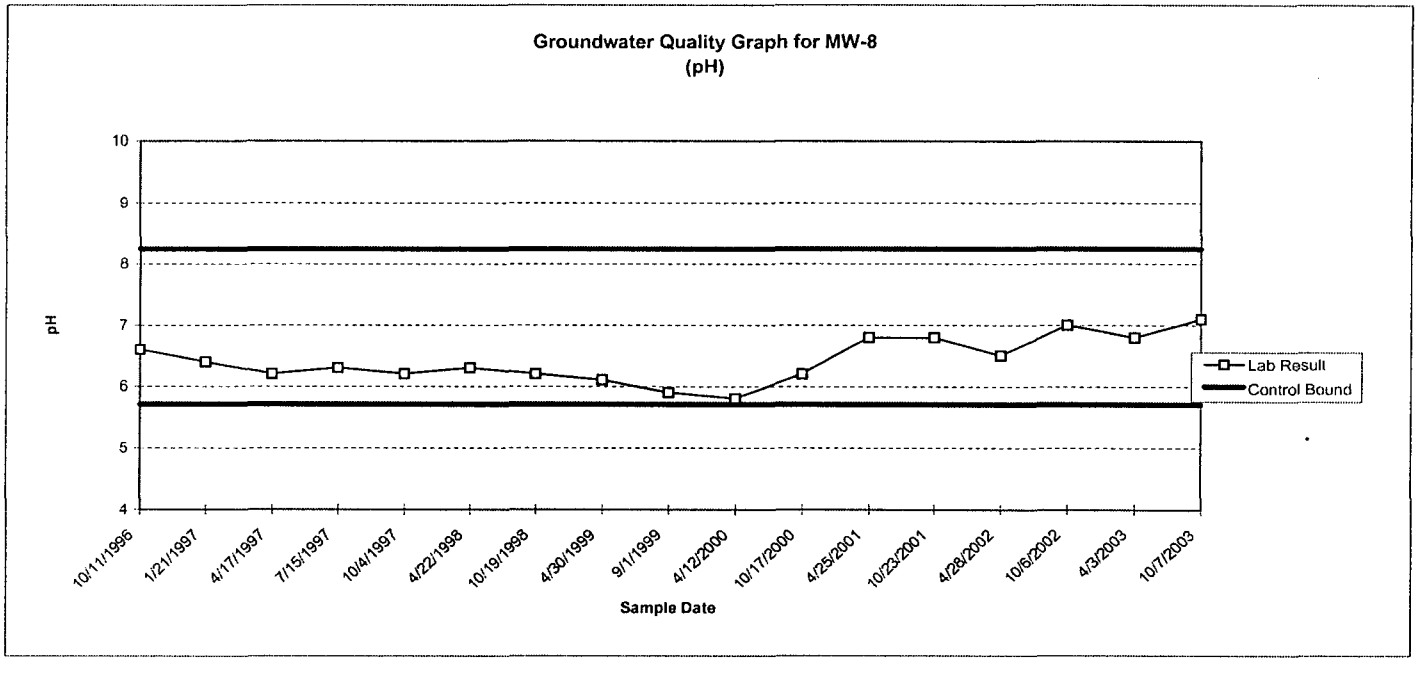



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).

**ANALYSIS SHEET MW-8**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**PROJECT NO. TERRACON 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

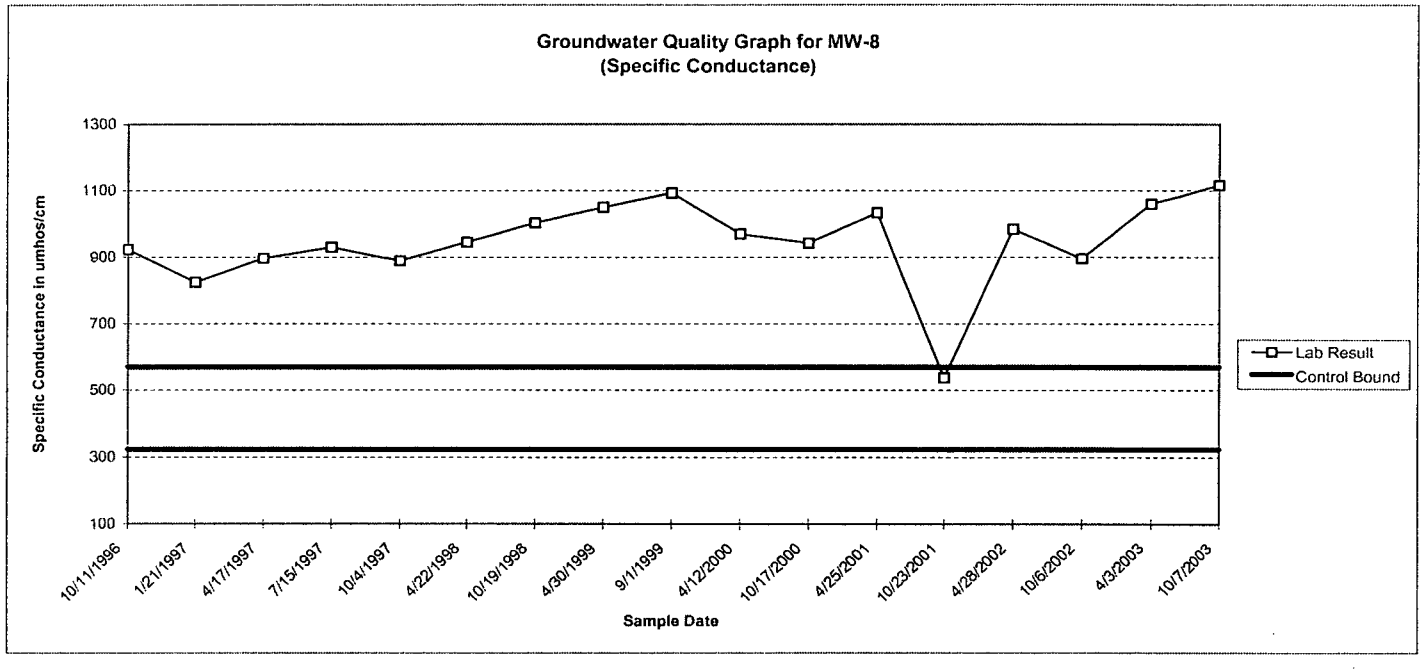



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-8

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-7

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

*SAMPLE LOCATION NO.* *MW-7* *(Up-gradient)*

*ANALYSIS PERFORMED BY:* *TestAmerica Laboratories* *SAMPLED BY:* *Plymouth County Landfill Personnel*

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-7 Standard Deviation | MW-7 Mean | 7/12/1996 | 10/10/1996 | 1/21/1997 | 4/17/1997 | 10/4/1997 | 4/22/1998 | 10/19/1998 | 4/30/1999 | 9/1/1999 | 4/12/2000 | 10/17/2000 |
| **Laboratory Parameters** | | | | | | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 2.042 | 5.406 | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | 6.9 | 6.6 | 6.7 | 5.9 | 6.4 | 5.5 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 9.581 | 5.788 | 42.0 | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.032 | 0.108 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.042 | 0.068 | **0.05** | **0.05** | **0.05** | **0.05** | 0.12 | **0.05** | **0.05** | **0.05** | **0.05** | 0.13 | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.252 | 0.533 | **0.5** | **0.5** | **0.25** | **0.25** | 0.75 | 0.74 | 0.81 | 0.8 | **0.25** | 0.8 | **0.25** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 4.575 | 1.776 | 10.6 | 16.6 | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.188 | 0.923 | **0.5** | **0.5** | **1.0** | **1.0** | **1.0** | **1.0** | **1.0** | - | **1.0** | **1.0** | - |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.000 | 0.500 | **0.5** | **0.5** | **0.5** | **0.5** | - | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 2.613 | 9.329 | 4.7 | 5.1 | 6.6 | 12.2 | 9.8 | 10.9 | 8.2 | 12.5 | 8.2 | 8.4 | 6.4 |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | - | - | - | - | **0.01** | - | **0.01** | - | **0.01** | - | **0.01** |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.017 | 0.082 | - | - | - | - | 0.095 | - | 0.051 | - | 0.104 | - | 0.067 |
| **Field Parameters** | | | | | | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.4 | 6.3 | 6.1 | 6.5 | 6.5 | 6 | 6.2 | 6.1 | 6.2 | 6.1 | 5.9 | 5.6 | 6 |
| Specific Conductance (umhos/cm) | 570 | 323 | 140 | 993 | 738 | 870 | 840 | 919 | 904 | 1001 | 1050 | 1094 | 1127 | 1041 | 1002 |

**NOTE:**

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.
6) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-7

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

*SAMPLE LOCATION NO.* *MW-7* *(Up-gradient)*

*ANALYSIS PERFORMED BY:* *TestAmerica Laboratories* *SAMPLED BY:* *Plymouth County Landfill Personnel*

| PARAMETER | Statistical Considerations | | | | SAMPLE DATE | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Upper Control Limit via MW-17 | Lower Control Limit via MW-17 | MW-7 Standard Deviation | MW-7 Mean | 4/25/2001 | 10/23/2001 | 4/28/2002 | 10/6/2002 | 4/3/2003 | 10/7/2003 |
| **Laboratory Parameters** | | | | | | | | | | |
| Chloride (mg/l) | 5.299 | 0.341 | 2.042 | 5.406 | 5.9 | 7.5 | 7.5 | 6.2 | 6.1 | 8.2 |
| Chemical Oxygen Demand (mg/l) | 8.331 | 0.000 | 9.581 | 5.788 | **2.5** | **2.5** | 7.3 | 9.3 | 7.3 | **2.5** |
| Ammonia Nitrogen (mg/l) | 0.100 | 0.100 | 0.032 | 0.108 | **0.1** | **0.1** | **0.1** | **0.1** | **0.1** | 0.23 |
| Iron, dissolved (mg/l) | 0.050 | 0.050 | 0.042 | 0.068 | 0.2 | **0.05** | **0.05** | **0.05** | **0.05** | **0.05** |
| Benzene (µg/l) | 0.250 | 0.250 | 0.252 | 0.533 | 0.6 | 1.0 | 0.5 | **0.25** | **0.25** | **0.56** |
| 1,2-Dichloroethane (µg/l) | 0.200 | 0.200 | 4.575 | 1.776 | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** | **0.2** |
| 1,1-Dichloroethene (µg/l) | 1.000 | 1.000 | 0.188 | 0.923 | - | - | **1.0** | **1.0** | **1.0** | **1.0** |
| 1,1,1-Trichloroethane (ug/l) | 0.500 | 0.500 | 0.000 | 0.500 | - | - | - | - | - | - |
| Trichloroethene (µg/l) | 0.500 | 0.500 | 2.613 | 9.329 | 8.4 | 10.7 | 12.0 | 13.4 | 10.4 | 10.7 |
| Phenols, Total (mg/l) | 0.010 | 0.010 | 0.000 | 0.010 | - | **0.01** | **0.01** | **0.01** | **0.01** | - |
| Total Organic Halogens (mg/l) | 0.005 | 0.005 | 0.017 | 0.082 | - | 0.083 | 0.086 | 0.093 | 0.073 | - |
| **Field Parameters** | | | | | | | | | | |
| pH | 8.2 | 5.7 | 0.4 | 6.3 | 6.7 | 6.7 | 6.3 | 6.5 | 6.7 | 7.1 |
| Specific Conductance (umhos/cm) | 570 | 323 | 140 | 993 | 1147 | 1102 | 784 | 1232 | 1127 | 910 |

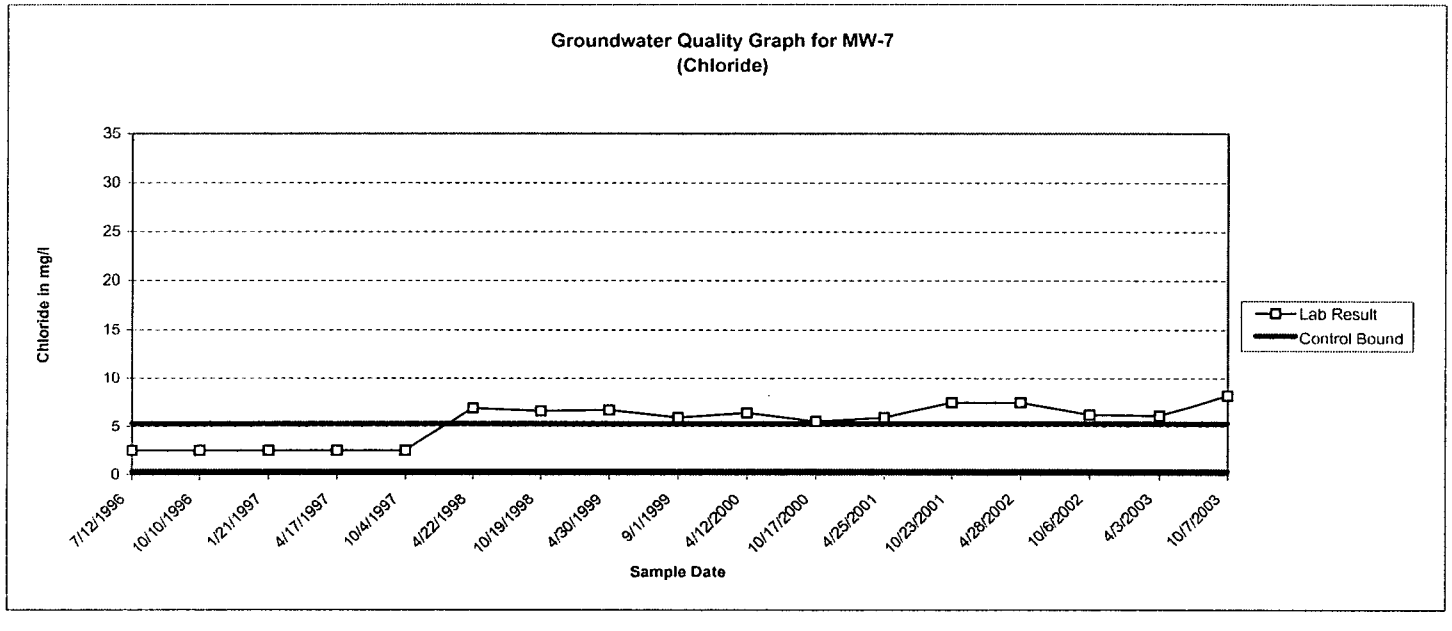
NOTE:

1) Statistical analysis included VOC chemicals that exhibited detectable concentrations during background monitoring.
2) Results shown in bold represent one-half of the laboratory detection limt (MDL) for parameters not detected.
3) One-half of the MDL was used for non-detected parameters to compute their respective control limits (mean +/- two times the standard deviation for the chemicals observed at MW-17).
4) One-half of the MDL was plotted for non-detectable parameters.
5) A lower control limit of zero (0) was used for those parameters in which a negative lower control limit was calculated.

**ANALYSIS SHEET MW-7**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**PROJECT NO. TERRACON 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

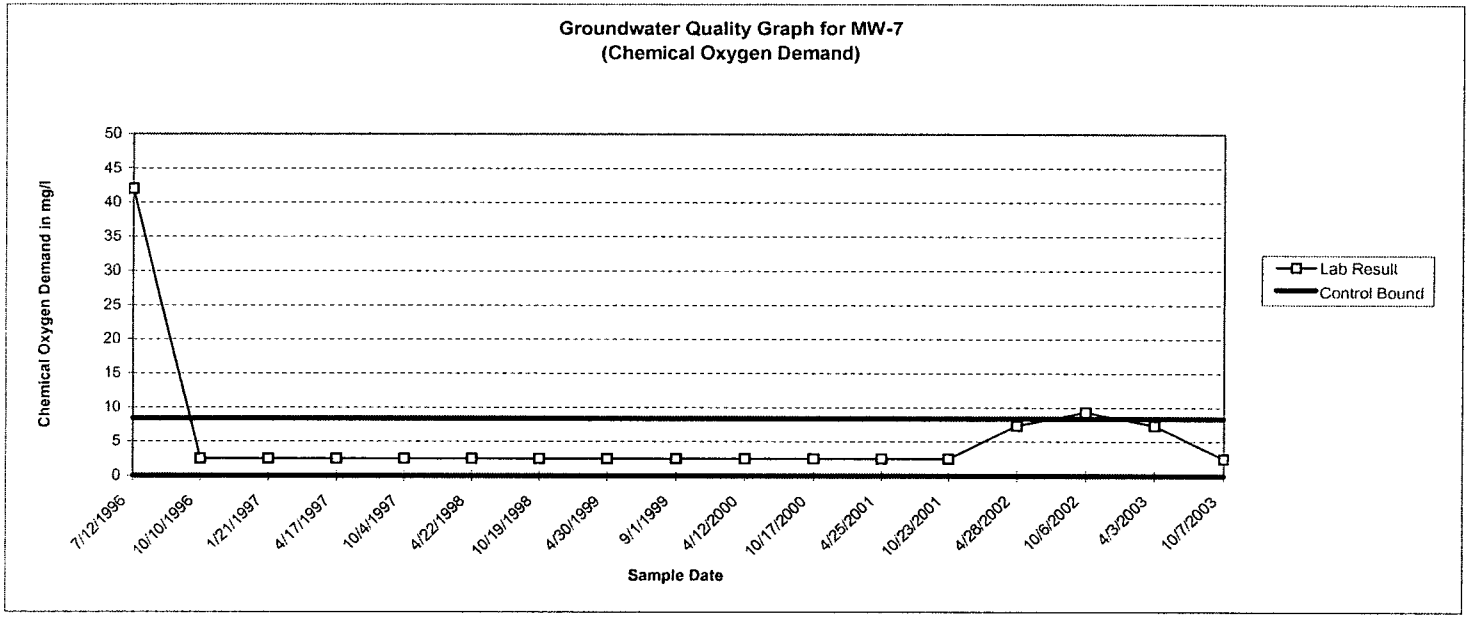



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-7

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET

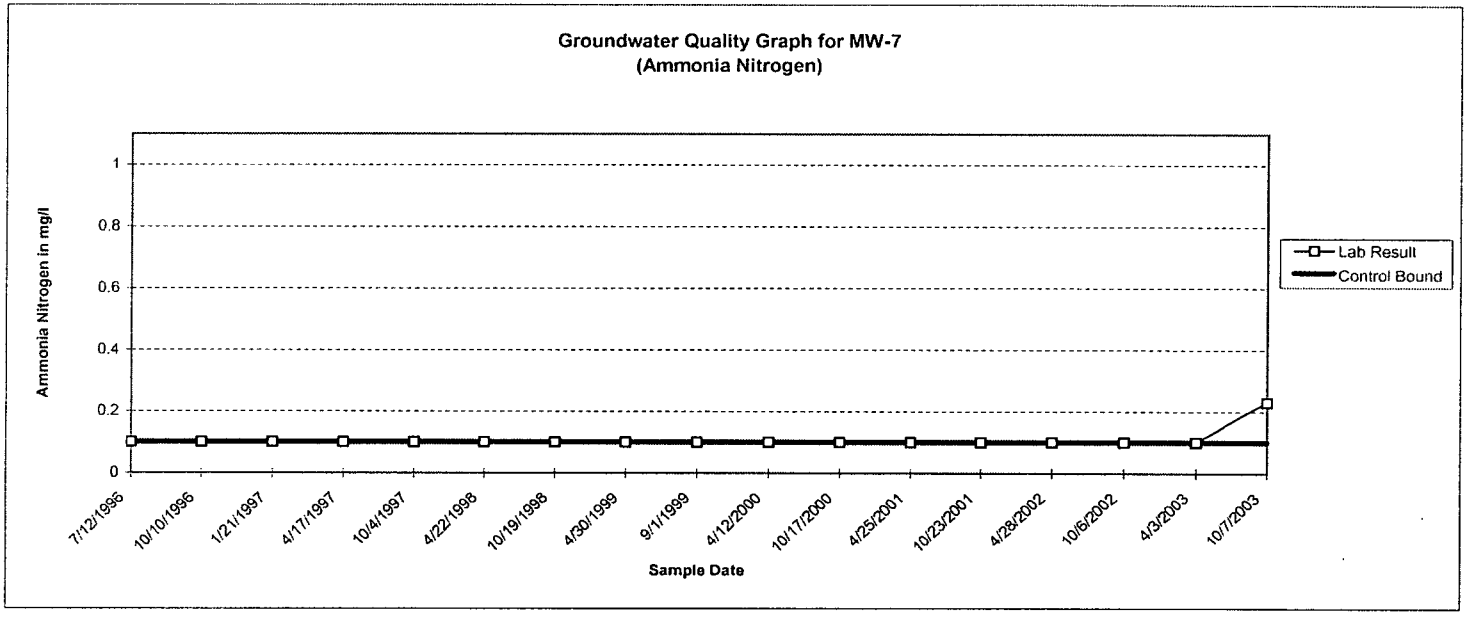



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-7

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-7

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

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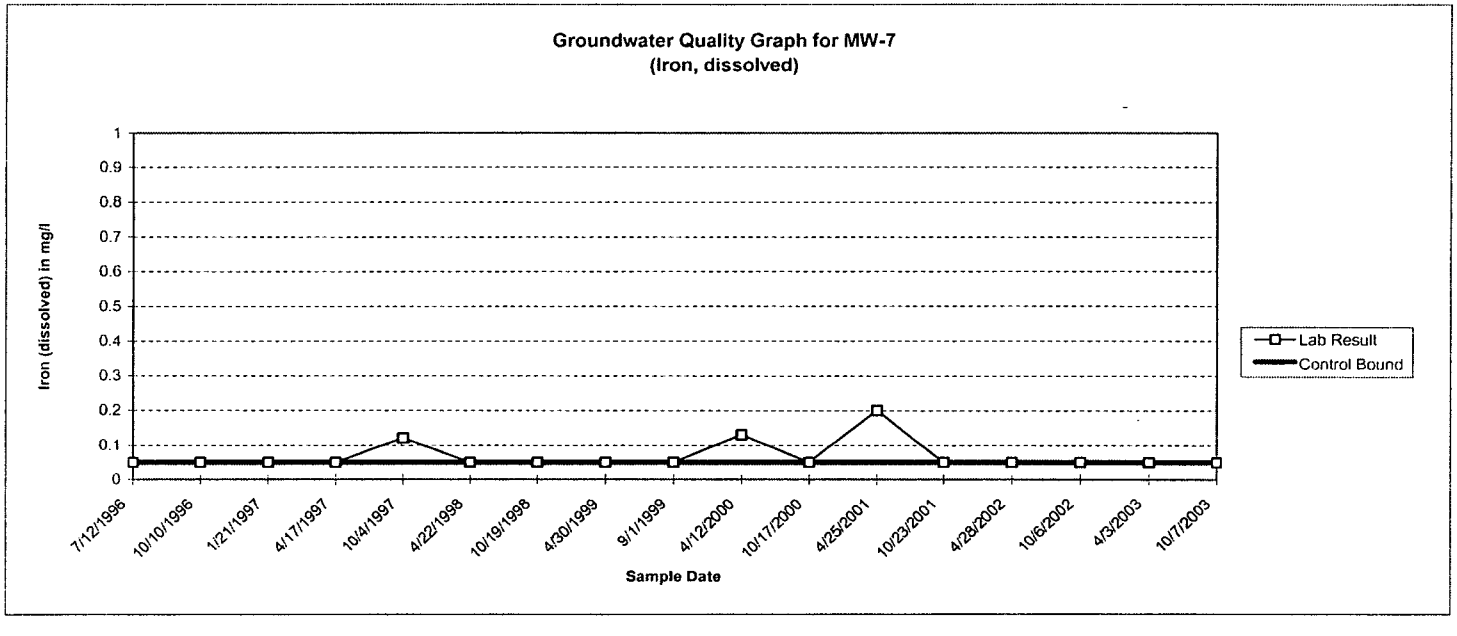


NOTE:
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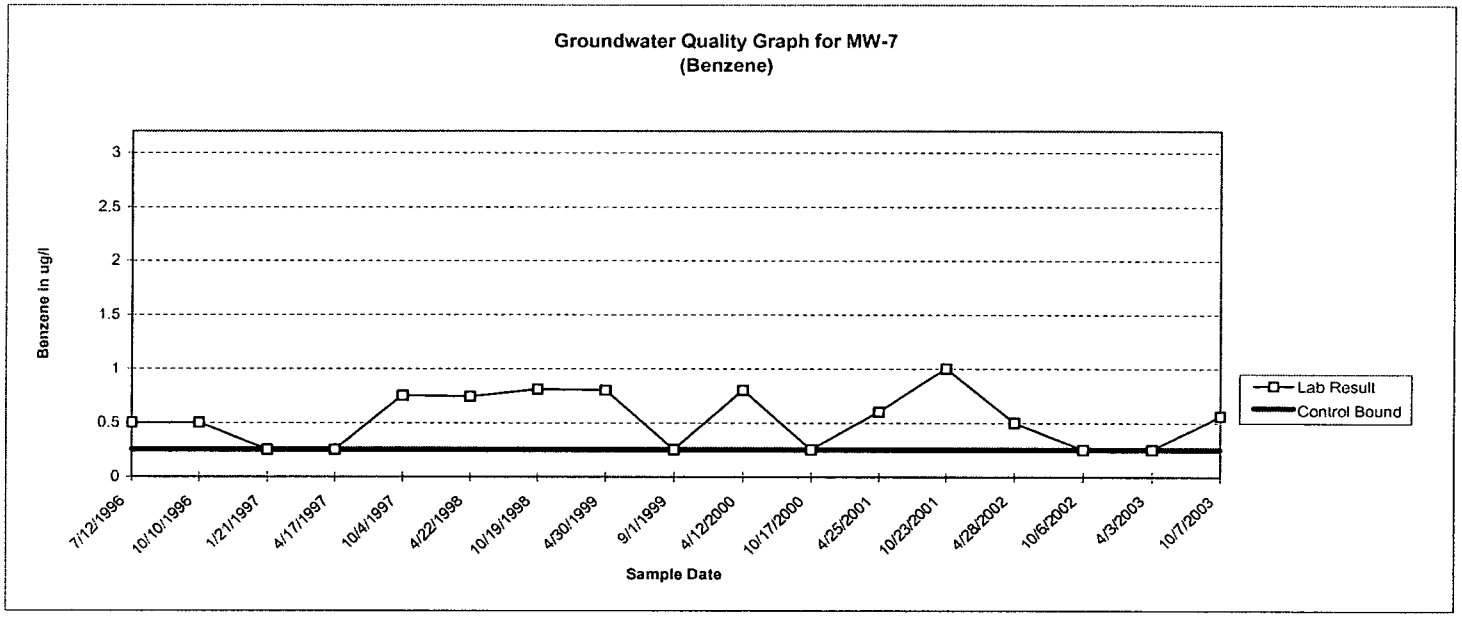
3) One-half of the MDL was plotted for non-detectable parameters.

**ANALYSIS SHEET MW-7**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**PROJECT NO. TERRACON 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**




NOTE:
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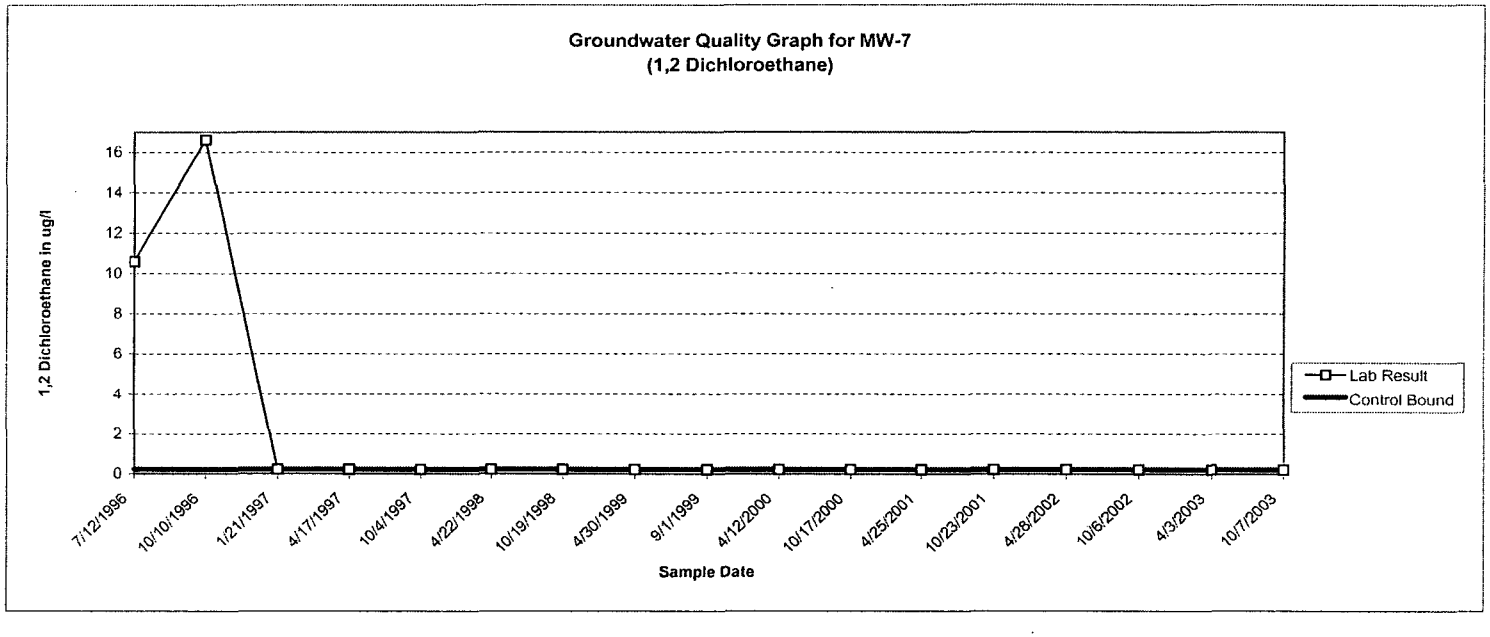
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
3) One-half of the MDL was plotted for non-detectable parameters.

## ANALYSIS SHEET MW-7

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
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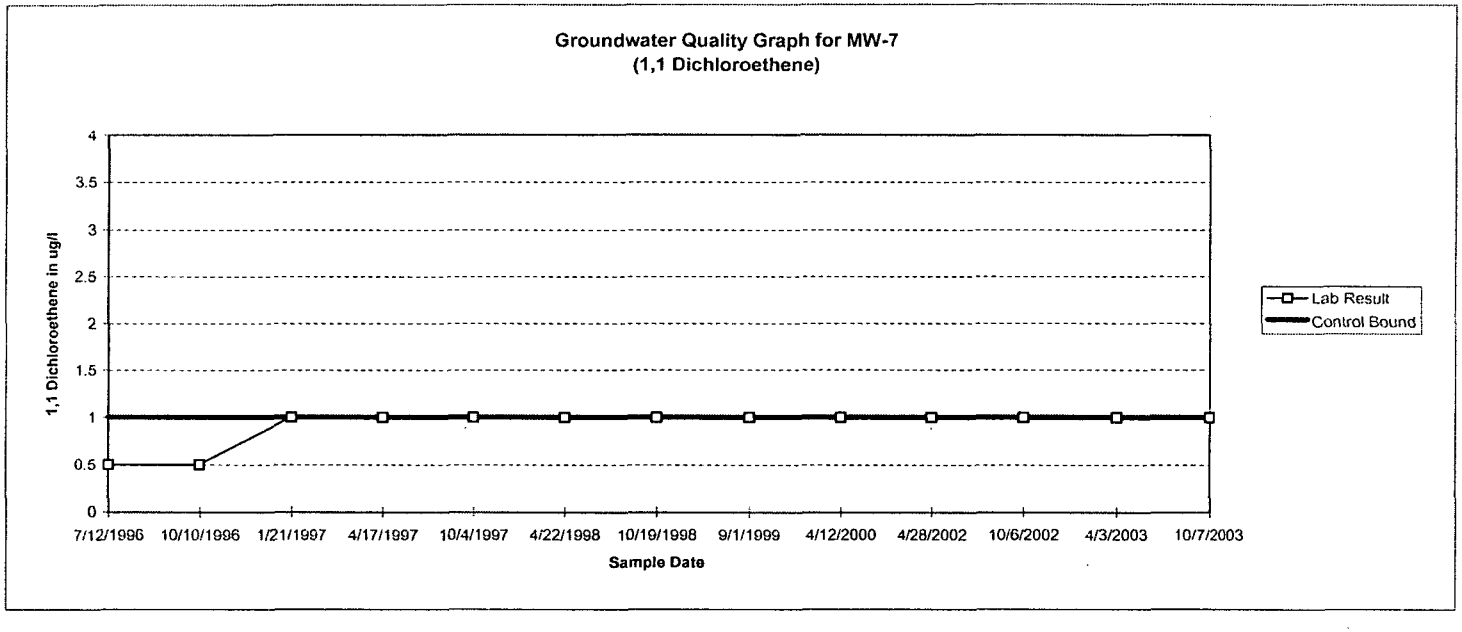
3) One-half of the MDL was plotted for non-detectable parameters.

**ANALYSIS SHEET MW-7**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**PROJECT NO. TERRACON 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**




NOTE:
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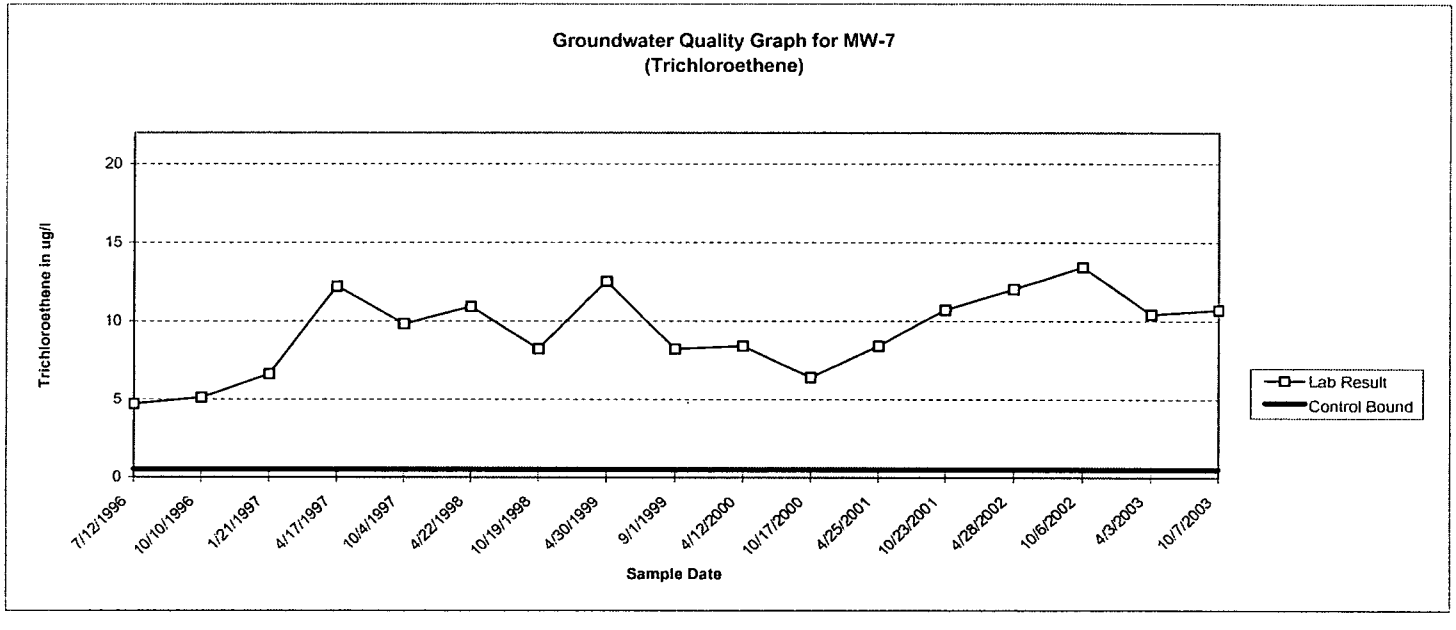
## ANALYSIS SHEET MW-7

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
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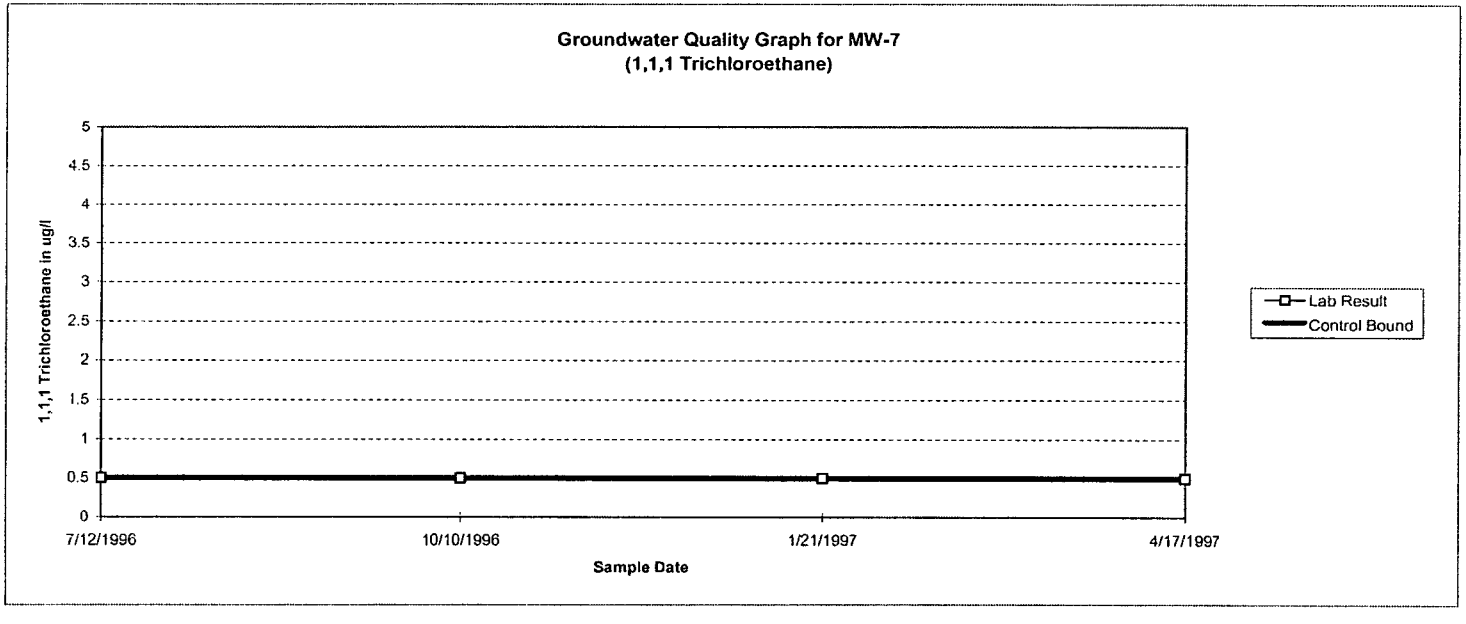
## ANALYSIS SHEET MW-7

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
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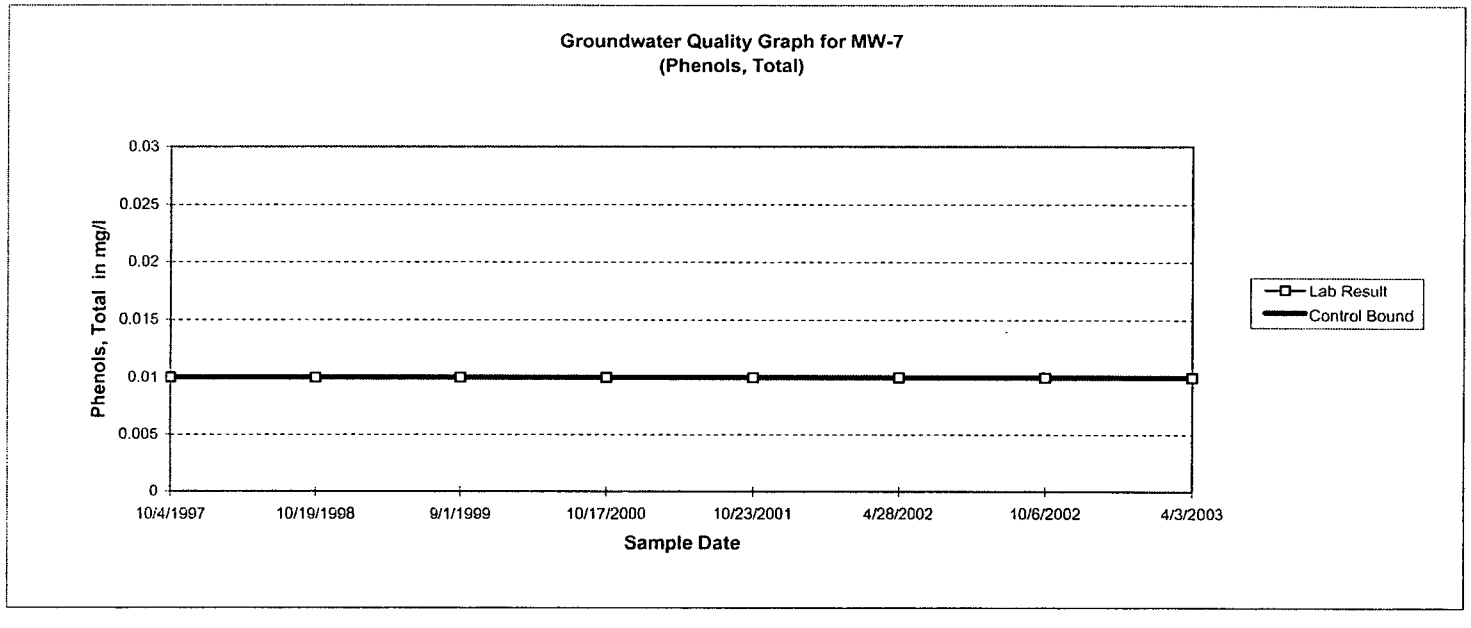
## ANALYSIS SHEET MW-7

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).
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## ANALYSIS SHEET MW-7

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

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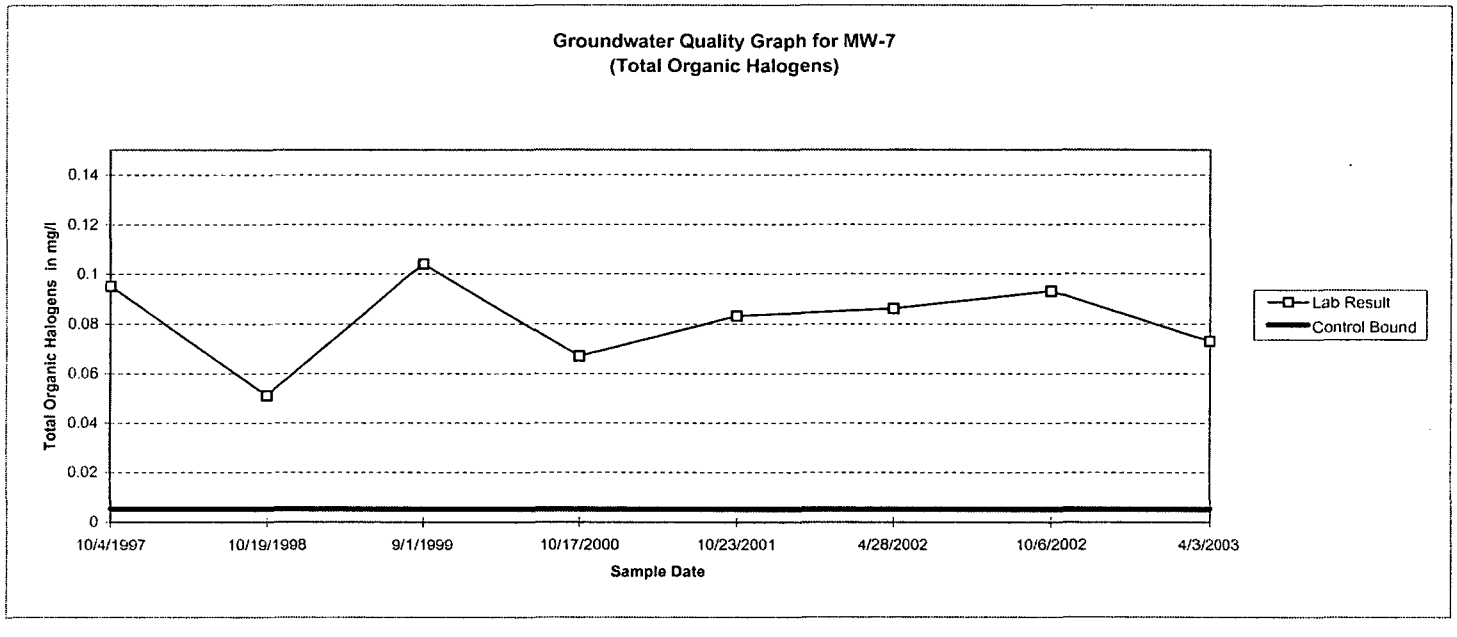


NOTE:
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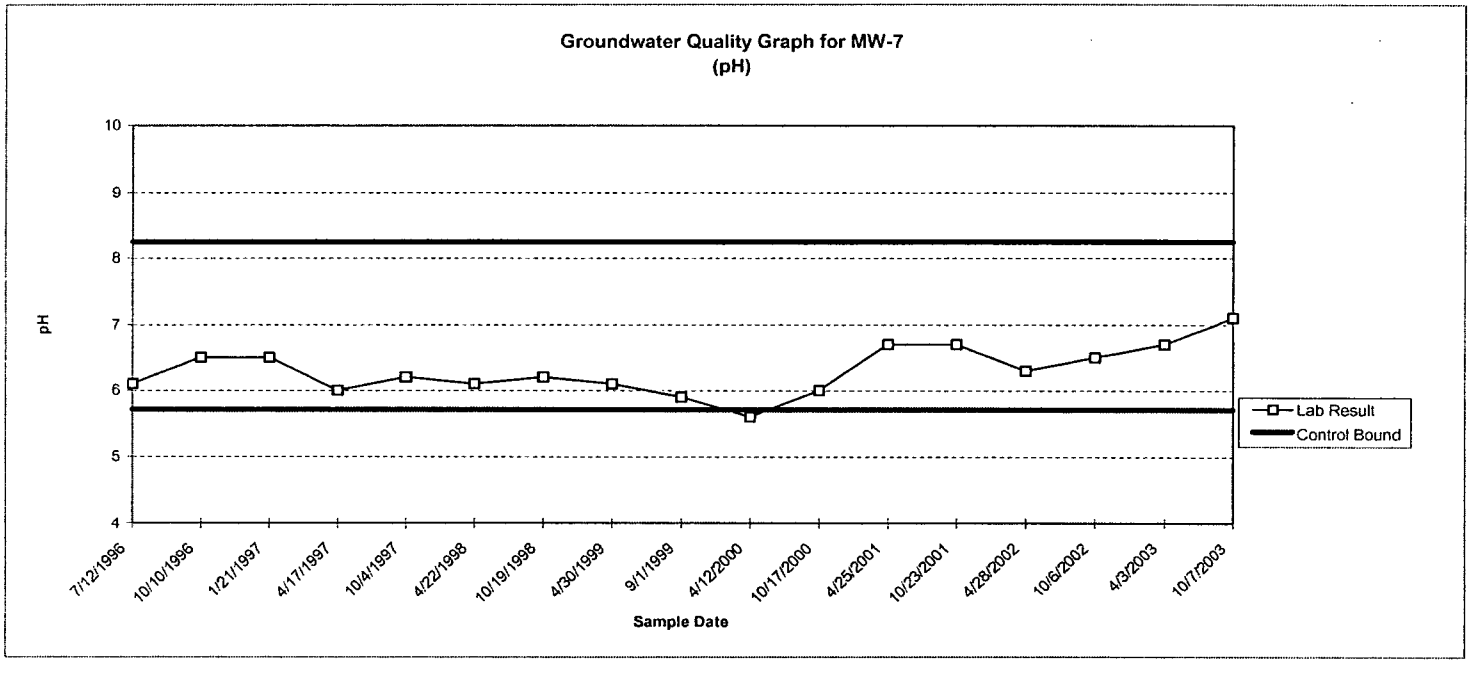
2) The same non-detectable concentration results for MW-17 resulted in a single control bound (i.e. there was no deviation from the mean of the data).

**ANALYSIS SHEET MW-7**

**PLYMOUTH COUNTY LANDFILL**
**GROUNDWATER SAMPLING AND ANALYSIS**
**PROJECT NO. TERRACON 40905033**

**SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET**

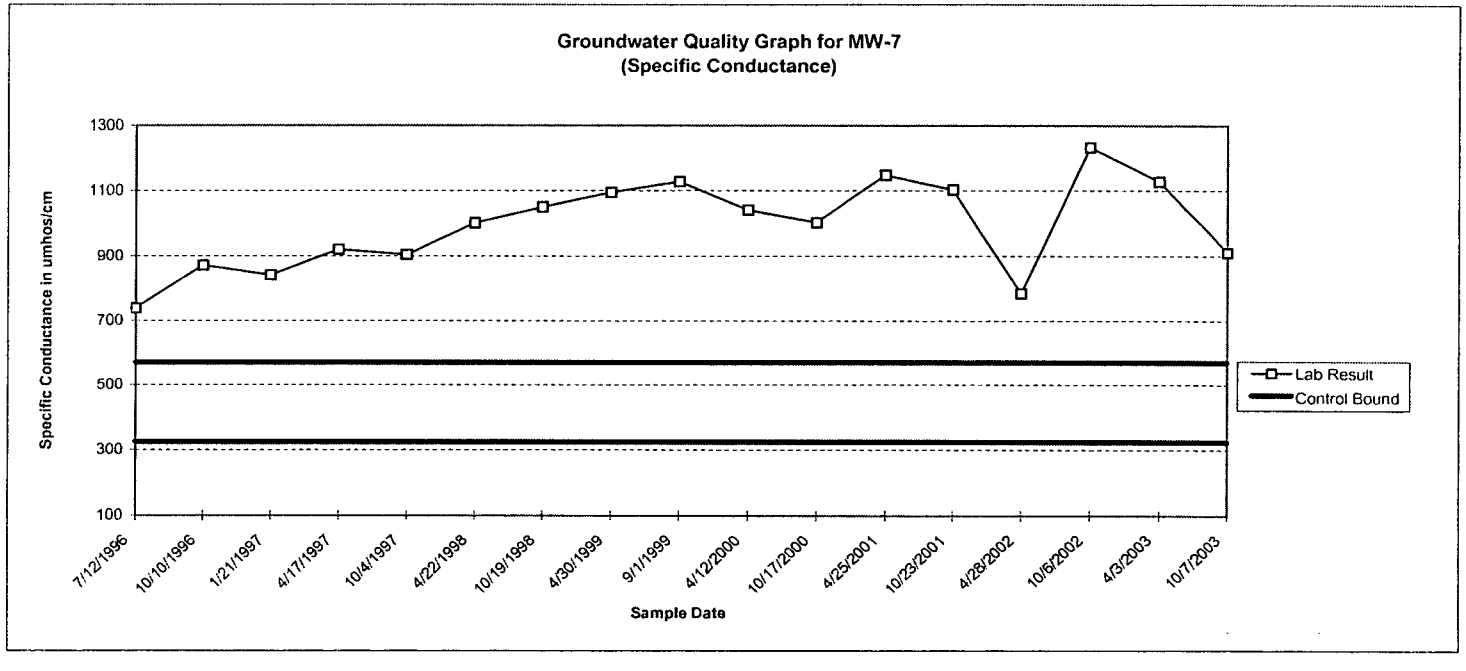



NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

## ANALYSIS SHEET MW-7

## PLYMOUTH COUNTY LANDFILL
## GROUNDWATER SAMPLING AND ANALYSIS
## PROJECT NO. TERRACON 40905033

## SEMI-ANNUAL, ANNUAL, AND SELECT VOC PARAMETERS STATISTICAL ANALYSIS SHEET




NOTE:
1) Results from Monitoring Well MW-17 (up-gradient well) were used to compute control limits.

# TABLE 1
## Plymouth County Landfill
## Terracon Project No. 40905033

Appendix C

## Summary of Groundwater Elevation Measurements

| Measurement Dates | | | December 16, 2002 | | January 20, 2003 | | February 12, 2003 | | March 14, 2003 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | TOC Elevation (feet) | Screened Interval Elevation (feet) | Depth to Water (feet) | Groundwater Elevation (feet) | Depth to Water (feet) | Groundwater Elevation (feet) | Depth to Water (feet) | Groundwater Elevation (feet) | Depth to Water (feet) | Groundwater Elevation (feet) |
| MW-7 | 1325.79 | 1303.4-1293.4 | 28.96 | 1296.83 | 28.28 | 1297.51 | 29.41 | 1296.38 | 29.73 | 1296.06 |
| MW-8 | 1314.12 | 1296.7-1286.7 | 23.48 | 1290.64 | 23.74 | 1290.38 | 23.92 | 1290.20 | 23.95 | 1290.17 |
| MW-9 | 1291.83 | 1277.1-1267.1 | dry | | dry | | dry | | dry | |
| MW-10 | 1264.66 | 1242.0-1232.0 | 31.10 | 1233.56 | 31.26 | 1233.40 | 31.31 | 1233.35 | 31.43 | 1233.23 |
| MW-11 | 1285.62 | 1258.0-1248.0 | 32.33 | 1253.29 | 32.53 | 1253.09 | 32.67 | 1252.95 | 32.83 | 1252.79 |
| MW-12 | 1333.20 | 1290.3-1280.3 | 45.52 | 1287.68 | 45.57 | 1287.63 | 45.81 | 1287.39 | 45.65 | 1287.55 |
| MW-13 | 1266.67 | 1244.8-1229.8 | 28.45 | 1238.22 | 28.56 | 1238.11 | 28.66 | 1238.01 | 28.65 | 1238.02 |
| MW-14 | 1302.41 | 1267.4-1252.4 | 46.92 | 1255.49 | 47.23 | 1255.18 | 47.36 | 1255.05 | 47.72 | 1254.69 |
| MW-15 | 1322.16 | 1294.4-1279.4 | 34.10 | 1288.06 | 34.20 | 1287.96 | 34.21 | 1287.95 | 34.28 | 1287.88 |
| MW-16 | 1330.02 | 1309.0-1294.0 | 33.08 | 1296.94 | 33.15 | 1296.87 | 33.58 | 1296.44 | 33.41 | 1296.61 |
| MW-17 | 1319.12 | 1301.1-1286.1 | 21.77 | 1297.35 | 22.24 | 1296.88 | 22.53 | 1296.59 | 22.88 | 1296.24 |

**NOTES:**
TOC = top of casing elevation (feet).
Water levels measured by landfill personnel.
Blank fields indicate no data.
Water levels fall within screened intervals except at MW-9.

# TABLE 1
## Plymouth County Landfill
## Terracon Project No. 40905033

## Summary of Groundwater Elevation Measurements

| Measurement Dates | | | April 2, 2003 | | May 30, 2003 | | June 16, 2003 | | July 17, 2003 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | TOC Elevation (feet) | Screened Interval Elevation (feet) | Depth to Water (feet) | Groundwater Elevation (feet) | Depth to Water (feet) | Groundwater Elevation (feet) | Depth to Water (feet) | Groundwater Elevation (feet) | Depth to Water (feet) | Groundwater Elevation (feet) |
| MW-7 | 1325.79 | 1303.4-1293.4 | 29.57 | 1296.22 | 28.57 | 1297.22 | 28.42 | 1297.37 | 28.05 | 1297.74 |
| MW-8 | 1314.12 | 1296.7-1286.7 | 24.10 | 1290.02 | 23.34 | 1290.78 | 22.85 | 1291.27 | 22.41 | 1291.71 |
| MW-9 | 1291.83 | 1277.1-1267.1 | dry | | dry | | dry | | dry | |
| MW-10 | 1264.66 | 1242.0-1232.0 | 31.15 | 1233.51 | 30.60 | 1234.06 | 30.58 | 1234.08 | 30.11 | 1234.55 |
| MW-11 | 1285.62 | 1258.0-1248.0 | 32.83 | 1252.79 | 32.66 | 1252.96 | 32.47 | 1253.15 | 32.12 | 1253.50 |
| MW-12 | 1333.20 | 1290.3-1280.3 | 45.68 | 1287.52 | 45.52 | 1287.68 | 45.42 | 1287.78 | 45.34 | 1287.86 |
| MW-13 | 1266.67 | 1244.8-1229.8 | 28.13 | 1238.54 | 27.83 | 1238.84 | 27.76 | 1238.91 | 27.27 | 1239.40 |
| MW-14 | 1302.41 | 1267.4-1252.4 | 47.61 | 1254.80 | 47.80 | 1254.61 | 47.76 | 1254.65 | 47.06 | 1255.35 |
| MW-15 | 1322.16 | 1294.4-1279.4 | 34.31 | 1287.85 | 33.92 | 1288.24 | 33.79 | 1288.37 | 33.67 | 1288.49 |
| MW-16 | 1330.02 | 1309.0-1294.0 | 35.98 | 1294.04 | 32.08 | 1297.94 | 32.23 | 1297.79 | 31.83 | 1298.19 |
| MW-17 | 1319.12 | 1301.1-1286.1 | 22.50 | 1296.62 | 20.46 | 1298.66 | 20.22 | 1298.90 | 20.08 | 1299.04 |

**NOTES:**
TOC = top of casing elevation (feet).
Water levels measured by landfill personnel.
Blank fields indicate no data.
Water levels fall within screened intervals except at MW-9.

# TABLE 1
## Plymouth County Landfill
## Terracon Project No. 40905033

## Summary of Groundwater Elevation Measurements

| Measurement Dates | | | August 28, 2003 | | September 16, 2003 | | October 6, 2003 | | November 17, 2003 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | TOC Elevation (feet) | Screened Interval Elevation (feet) | Depth to Water (feet) | Groundwater Elevation (feet) | Depth to Water (feet) | Groundwater Elevation (feet) | Depth to Water (feet) | Groundwater Elevation (feet) | Depth to Water (feet) | Groundwater Elevation (feet) |
| MW-7 | 1325.79 | 1303.4-1293.4 | 27.63 | 1298.16 | 27.75 | 1298.04 | 27.78 | 1298.01 | 28.09 | 1297.70 |
| MW-8 | 1314.12 | 1296.7-1286.7 | 22.34 | 1291.78 | 22.76 | 1291.36 | 23.27 | 1290.85 | 23.83 | 1290.29 |
| MW-9 | 1291.83 | 1277.1-1267.1 | dry | | dry | | dry | | dry | |
| MW-10 | 1264.66 | 1242.0-1232.0 | 30.27 | 1234.39 | 30.58 | 1234.08 | 30.74 | 1233.92 | 30.94 | 1233.72 |
| MW-11 | 1285.62 | 1258.0-1248.0 | 32.01 | 1253.61 | 32.16 | 1253.46 | 32.29 | 1253.33 | 32.39 | 1253.23 |
| MW-12 | 1333.20 | 1290.3-1280.3 | 45.24 | 1287.96 | 45.24 | 1287.96 | 45.26 | 1287.94 | 45.35 | 1287.85 |
| MW-13 | 1266.67 | 1244.8-1229.8 | 27.74 | 1238.93 | 27.90 | 1238.77 | 26.16 | 1240.51 | 28.12 | 1238.55 |
| MW-14 | 1302.41 | 1267.4-1252.4 | 46.56 | 1255.85 | 46.66 | 1255.75 | 45.82 | 1256.59 | 46.76 | 1255.65 |
| MW-15 | 1322.16 | 1294.4-1279.4 | 33.84 | 1288.32 | 33.88 | 1288.28 | 33.69 | 1288.47 | 34.01 | 1288.15 |
| MW-16 | 1330.02 | 1309.0-1294.0 | 31.53 | 1298.49 | 31.78 | 1298.24 | 31.82 | 1298.20 | 32.23 | 1297.79 |
| MW-17 | 1319.12 | 1301.1-1286.1 | 20.50 | 1298.62 | 20.91 | 1298.21 | 20.97 | 1298.15 | 21.45 | 1297.67 |

**NOTES:**
TOC = top of casing elevation (feet).
Water levels measured by landfill personnel.
Blank fields indicate no data.
Water levels fall within screened intervals except at MW-9.

# TABLE 2
## Plymouth County Landfill
## Terracon Project 40905033

## Summary of Leachate Measurements

| Location | Measurement Dates | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dec 16 2002 | Jan 20 2003 | Feb 12 2003 | Mar 14 2003 | Apr 2 2003 | May 30 2003 | Jun 16 2003 | Jul 17 2003 | Aug 28 2003 | Sep 16 2003 | Oct 8 2003 | Nov 17 2003 |
| LW-1 | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches |
| LW-2 | 6 inches | 6 inches | 8 inches | 6 inches | 5 inches | 5 inches | 5 inches | 5 inches | 5 inches | 5 inches | 5 inches | 5 inches |
| LW-3 | 9 inches | 10 inches | 10 inches | 10 inches | 9 inches | 9 inches | 9 inches | 9 inches | 9 inches | 9 inches | 9 inches | 9 inches |
| LW-4 | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches | 3 inches |

NOTES:
Leachate levels measured by landfill personnel.
Blank fields indicate no data.
Values represent leachate thickness at bottom of leachate well.

**TABLE 3**
**Plymouth County Landfill**
**Terracon Project 40905033**

**Summary of Hydraulic Conductivities**

| | MONITORING WELLS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | MW-7 | MW-8 | MW-9 | MW-10 | MW-11 | MW-12 | MW-13 | MW-14 | MW-15 | MW-16 | MW-17 |
| March 1991 | 2.00E-04 | 9.70E-06 | 1.40E-04 | 8.90E-06 | 6.10E-04 | 5.30E-05 | | | | | |
| May 1998 | 1.78E-04 | 3.33E-05 | 3.81E-05 | 4.50E-03 | 3.89E-04 | 3.30E-05 | 1.43E-04 | 1.31E-04 | 5.31E-05 | 9.23E-06 | 1.29E-05 |
| November 2003 | 1.34E-04 | 1.09E-05 | | | 3.31E-04 | 1.83E-04 | 2.96E-04 | 1.94E-04 | 5.26E-05 | 2.88E-05 | 9.63E-06 |

Hydraulic conductivity values given in units of centimeters per second (cm/sec).

Blank cells indicate no testing was performed.

Wells MW-13, MW-14, MW-15, MW-16 and MW-17 did not exist at the time of hydraulic conductivity testing in 1991.

Wells MW-9 and MW-10 had insufficient water for hydraulic conductivity testing in 2003.

# BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-7**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

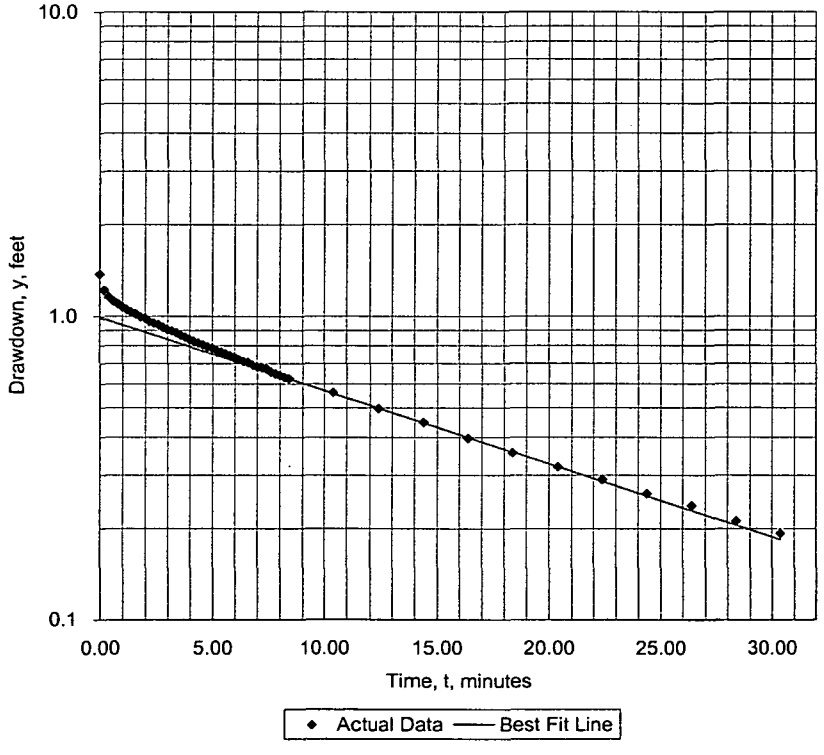
Appendix D

| Well Geometry | | | |
|---|---|---|---|
| Saturated Thickness (H), ft. | 50 | Radius of Well Casing (Rc), in | 1 |
| Screen Length, ft. | 10 | Radius of Boring (Rw), in | 4 |
| Depth to Water, ft. | 28.25 | Gravel Pack Porosity (n), % | 20% |
| Well Depth, ft. | 32.4 | Time Delay Factor, min: | 1.60 |

| Computed Data | | | |
|---|---|---|---|
| Effective Well Radius (Re), in. | 2.0 | Lw/Rw, ft/ft | 12.45 |
| Effective Screen Length (Le), ft. | 4.15 | Lw, ft | 4.15 |
| Full or Partial Penetration (F/P) | Partial | Le/Rw, ft/ft | 12.45 |

| Well Geometry Factors (See Attached Graph) | | |
|---|---|---|
| A | 1.9488 | Note: |
| B | 0.28215 | - Factors A and B are used for a partially penetrating well |
| C | | - Factor C is used for a fully penetrating well |

## BOUWER AND RICE SLUG TEST ANALYSIS




| Regression Analysis (Ln y vs. t) | |
|---|---|
| Slope of Line, (1/minutes): | 0.055443372 |
| Yo, ft | 0.992421237 |
| Ln(Re/rw) | 1.419787353 |
| Regression Coefficient, R^2: | 100% |

| Determination of Hydraulic Conductivity | |
|---|---|
| Conductivity, ft/minute | 2.63E-04 |
| ft/day | 3.79E-01 |
| cm/sec | 1.34E-04 |
| m/day | 1.16E-01 |

References:


1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.

2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-7**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

| Elapsed Time minutes | Corrected Time (t) minutes | Depth to Water feet | Drawdown feet | Predicted Drawdown feet |
|---|---|---|---|---|
| 1.6000 | 0.0000 | 29.626 | 1.376 | 0.992421237 |
| 1.8000 | 0.2000 | 29.468 | 1.218 | 0.981477389 |
| 2.0000 | 0.4000 | 29.409 | 1.159 | 0.970654224 |
| 2.2000 | 0.6000 | 29.374 | 1.124 | 0.95995041 |
| 2.4000 | 0.8000 | 29.351 | 1.101 | 0.949364632 |
| 2.6000 | 1.0000 | 29.322 | 1.072 | 0.938895588 |
| 2.8000 | 1.2000 | 29.303 | 1.053 | 0.928541991 |
| 3.0000 | 1.4000 | 29.283 | 1.033 | 0.918302566 |
| 3.2000 | 1.6000 | 29.267 | 1.017 | 0.908176057 |
| 3.4000 | 1.8000 | 29.245 | 0.995 | 0.898161216 |
| 3.6000 | 2.0000 | 29.235 | 0.985 | 0.888256814 |
| 3.8000 | 2.2000 | 29.212 | 0.962 | 0.878461631 |
| 4.0000 | 2.4000 | 29.199 | 0.949 | 0.868774464 |
| 4.2000 | 2.6000 | 29.186 | 0.936 | 0.859194122 |
| 4.4000 | 2.8000 | 29.17 | 0.92 | 0.849719426 |
| 4.6000 | 3.0000 | 29.154 | 0.904 | 0.840349212 |
| 4.8000 | 3.2000 | 29.144 | 0.894 | 0.831082326 |
| 5.0000 | 3.4000 | 29.131 | 0.881 | 0.821917631 |
| 5.2000 | 3.6000 | 29.115 | 0.865 | 0.812853999 |
| 5.4000 | 3.8000 | 29.102 | 0.852 | 0.803890315 |
| 5.6000 | 4.0000 | 29.089 | 0.839 | 0.795025477 |
| 5.8000 | 4.2000 | 29.077 | 0.827 | 0.786258396 |
| 6.0000 | 4.4000 | 29.067 | 0.817 | 0.777587993 |
| 6.2000 | 4.6000 | 29.054 | 0.804 | 0.769013202 |
| 6.4000 | 4.8000 | 29.041 | 0.791 | 0.760532969 |
| 6.6000 | 5.0000 | 29.035 | 0.785 | 0.752146252 |
| 6.8000 | 5.2000 | 29.022 | 0.772 | 0.743852018 |
| 7.0000 | 5.4000 | 29.012 | 0.762 | 0.735649248 |
| 7.2000 | 5.6000 | 29.002 | 0.752 | 0.727536933 |
| 7.4000 | 5.8000 | 28.989 | 0.739 | 0.719514077 |
| 7.6000 | 6.0000 | 28.983 | 0.733 | 0.711579692 |
| 7.8000 | 6.2000 | 28.97 | 0.72 | 0.703732802 |
| 8.0000 | 6.4000 | 28.96 | 0.71 | 0.695972444 |
| 8.2000 | 6.6000 | 28.954 | 0.704 | 0.688297662 |
| 8.4000 | 6.8000 | 28.941 | 0.691 | 0.680707513 |
| 8.6000 | 7.0000 | 28.931 | 0.681 | 0.673201065 |
| 8.8000 | 7.2000 | 28.928 | 0.678 | 0.665777393 |
| 9.0000 | 7.4000 | 28.921 | 0.671 | 0.658435584 |
| 9.2000 | 7.6000 | 28.905 | 0.655 | 0.651174738 |
| 9.4000 | 7.8000 | 28.896 | 0.646 | 0.643993959 |
| 9.6000 | 8.0000 | 28.889 | 0.639 | 0.636892366 |
| 9.8000 | 8.2000 | 28.879 | 0.629 | 0.629869085 |
| 10.0000 | 8.4000 | 28.873 | 0.623 | 0.622923253 |
| 12.0000 | 10.4000 | 28.812 | 0.562 | 0.557541298 |
| 14.0000 | 12.4000 | 28.747 | 0.497 | 0.499021825 |
| 16.0000 | 14.4000 | 28.698 | 0.448 | 0.44664455 |
| 18.0000 | 16.4000 | 28.647 | 0.397 | 0.399764788 |
| 20.0000 | 18.4000 | 28.605 | 0.355 | 0.35780552 |
| 22.0000 | 20.4000 | 28.569 | 0.319 | 0.320250292 |
| 24.0000 | 22.4000 | 28.54 | 0.29 | 0.286636857 |
| 26.0000 | 24.4000 | 28.511 | 0.261 | 0.256551484 |
| 28.0000 | 26.4000 | 28.488 | 0.238 | 0.229623869 |
| 30.0000 | 28.4000 | 28.462 | 0.212 | 0.205522573 |
| 32.0000 | 30.4000 | 28.443 | 0.193 | 0.183950947 |

## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

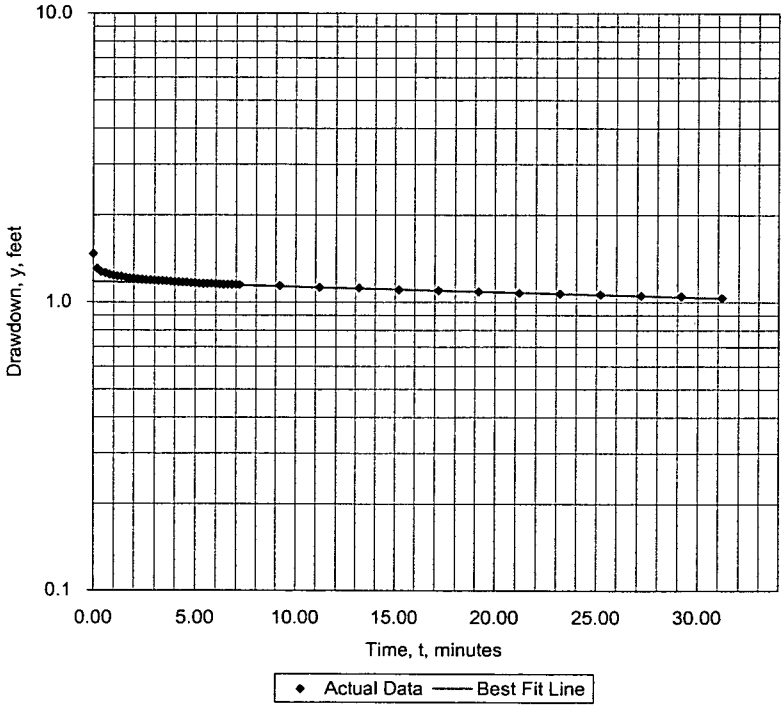
**MONITORING WELL MW-8**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

| Well Geometry | | | |
|---|---|---|---|
| Saturated Thickness (H), ft. | 50 | Radius of Well Casing (Rc), in | 1 |
| Screen Length, ft. | 10 | Radius of Boring (Rw), in | 4 |
| Depth to Water, ft. | 23.79 | Gravel Pack Porosity (n), % | 20% |
| Well Depth, ft. | 27.4 | Time Delay Factor, min: | 2.80 |

| Computed Data | | | |
|---|---|---|---|
| Effective Well Radius (Re), in. | 2.0 | Lw/Rw, ft/ft | 10.83 |
| Effective Screen Length (Le), ft. | 3.61 | Lw, ft | 3.61 |
| Full or Partial Penetration (F/P) | Partial | Le/Rw, ft/ft | 10.83 |

| Well Geometry Factors (See Attached Graph) | | |
|---|---|---|
| A | 1.90992 | Note: |
| B | 0.27081 | - Factors A and B are used for a partially penetrating well |
| C | | - Factor C is used for a fully penetrating well |

## BOUWER AND RICE SLUG TEST ANALYSIS




| Regression Analysis (Ln y vs. t) | |
|---|---|
| Slope of Line, (1/minutes): | 0.004226243 |
| Yo, ft | 1.179038236 |
| Ln(Re/rw) | 1.313181964 |
| Regression Coefficient, R^2: | 100% |

| Determination of Hydraulic Conductivity | | |
|---|---|---|
| Conductivity, | ft/minute | 2.14E-05 |
| | ft/day | 3.07E-02 |
| | cm/sec | 1.09E-05 |
| | m/day | 9.38E-03 |

References:


1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.

2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-8**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

| Elapsed Time minutes | Corrected Time (t) minutes | Depth to Water feet | Drawdown feet | Predicted Drawdown feet |
|---|---|---|---|---|
| 2.8000 | 0.0000 | 25.256 | 1.466 | 1.179038236 |
| 3.0000 | 0.2000 | 25.095 | 1.305 | 1.178042077 |
| 3.2000 | 0.4000 | 25.062 | 1.272 | 1.177046759 |
| 3.4000 | 0.6000 | 25.049 | 1.259 | 1.176052283 |
| 3.6000 | 0.8000 | 25.033 | 1.243 | 1.175058646 |
| 3.8000 | 1.0000 | 25.024 | 1.234 | 1.174065849 |
| 4.0000 | 1.2000 | 25.02 | 1.23 | 1.173073891 |
| 4.2000 | 1.4000 | 25.014 | 1.224 | 1.172082771 |
| 4.4000 | 1.6000 | 25.004 | 1.214 | 1.171092488 |
| 4.6000 | 1.8000 | 25.001 | 1.211 | 1.170103042 |
| 4.8000 | 2.0000 | 24.998 | 1.208 | 1.169114432 |
| 5.0000 | 2.2000 | 24.991 | 1.201 | 1.168126657 |
| 5.2000 | 2.4000 | 24.988 | 1.198 | 1.167139717 |
| 5.4000 | 2.6000 | 24.985 | 1.195 | 1.166153611 |
| 5.6000 | 2.8000 | 24.981 | 1.191 | 1.165168337 |
| 5.8000 | 3.0000 | 24.978 | 1.188 | 1.164183897 |
| 6.0000 | 3.2000 | 24.975 | 1.185 | 1.163200288 |
| 6.2000 | 3.4000 | 24.975 | 1.185 | 1.16221751 |
| 6.4000 | 3.6000 | 24.972 | 1.182 | 1.161235562 |
| 6.6000 | 3.8000 | 24.969 | 1.179 | 1.160254444 |
| 6.8000 | 4.0000 | 24.965 | 1.175 | 1.159274155 |
| 7.0000 | 4.2000 | 24.965 | 1.175 | 1.158294694 |
| 7.2000 | 4.4000 | 24.962 | 1.172 | 1.157316061 |
| 7.4000 | 4.6000 | 24.962 | 1.172 | 1.156338254 |
| 7.6000 | 4.8000 | 24.956 | 1.166 | 1.155361274 |
| 7.8000 | 5.0000 | 24.956 | 1.166 | 1.154385119 |
| 8.0000 | 5.2000 | 24.949 | 1.159 | 1.153409789 |
| 8.2000 | 5.4000 | 24.949 | 1.159 | 1.152435283 |
| 8.4000 | 5.6000 | 24.949 | 1.159 | 1.1514616 |
| 8.6000 | 5.8000 | 24.949 | 1.159 | 1.15048874 |
| 8.8000 | 6.0000 | 24.946 | 1.156 | 1.149516702 |
| 9.0000 | 6.2000 | 24.943 | 1.153 | 1.148545485 |
| 9.2000 | 6.4000 | 24.939 | 1.149 | 1.147575089 |
| 9.4000 | 6.6000 | 24.939 | 1.149 | 1.146605513 |
| 9.6000 | 6.8000 | 24.939 | 1.149 | 1.145636756 |
| 9.8000 | 7.0000 | 24.939 | 1.149 | 1.144668817 |
| 10.0000 | 7.2000 | 24.936 | 1.146 | 1.143701696 |
| 12.0000 | 9.2000 | 24.927 | 1.137 | 1.134075314 |
| 14.0000 | 11.2000 | 24.914 | 1.124 | 1.124529957 |
| 16.0000 | 13.2000 | 24.907 | 1.117 | 1.115064941 |
| 18.0000 | 15.2000 | 24.891 | 1.101 | 1.105679591 |
| 20.0000 | 17.2000 | 24.885 | 1.095 | 1.096373237 |
| 22.0000 | 19.2000 | 24.875 | 1.085 | 1.087145212 |
| 24.0000 | 21.2000 | 24.865 | 1.075 | 1.077994859 |
| 26.0000 | 23.2000 | 24.859 | 1.069 | 1.068921523 |
| 28.0000 | 25.2000 | 24.849 | 1.059 | 1.059924556 |
| 30.0000 | 27.2000 | 24.843 | 1.053 | 1.051003315 |
| 32.0000 | 29.2000 | 24.836 | 1.046 | 1.042157164 |
| 34.0000 | 31.2000 | 24.823 | 1.033 | 1.033385469 |
| | | | | |

## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-11**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

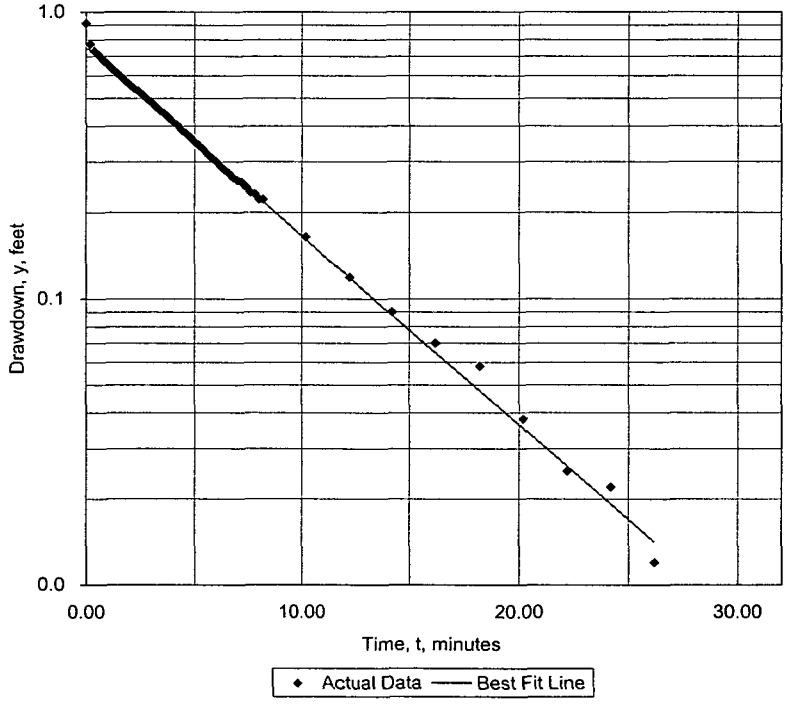
| Well Geometry | | | |
|---|---|---|---|
| Saturated Thickness (H), ft. | 50 | Radius of Well Casing (Rc), in | 1 |
| Screen Length, ft. | 10 | Radius of Boring (Rw), in | 4 |
| Depth to Water, ft. | 32.47 | Gravel Pack Porosity (n), % | 20% |
| Well Depth, ft. | 37.6 | Time Delay Factor, min: | 1.80 |

| Computed Data | | | |
|---|---|---|---|
| Effective Well Radius (Re), in. | 2.0 | Lw/Rw, ft/ft | 15.39 |
| Effective Screen Length (Le), ft. | 5.13 | Lw, ft | 5.13 |
| Full or Partial Penetration (F/P) | Partial | Le/Rw, ft/ft | 15.39 |

Well Geometry Factors (See Attached Graph)

| | | |
|---|---|---|
| A | 2.02482 | Note: |
| B | 0.30273 | - Factors A and B are used for a partially penetrating well |
| C | | - Factor C is used for a fully penetrating well |

## BOUWER AND RICE SLUG TEST ANALYSIS




| Regression Analysis (Ln y vs. t) | | Determination of Hydraulic Conductivity | |
|---|---|---|---|
| Slope of Line, (1/minutes): | 0.151642487 | Conductivity, ft/minute | 6.51E-04 |
| Yo, ft | 0.755414472 | ft/day | 9.38E-01 |
| Ln(Re/rw) | 1.586339019 | cm/sec | 3.31E-04 |
| Regression Coefficient, R^2: | 100% | m/day | 2.86E-01 |

NOTE: The first three data points are thought to be indicative of filter pack drainage and are, therefore, not included in the linear regression analysis.

References:

1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.

2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-11**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

| Elapsed Time minutes | Corrected Time (t) minutes | Depth to Water feet | Drawdown feet | Predicted Drawdown feet |
|---|---|---|---|---|
| 1.8000 | 0.0000 | 33.384 | 0.914 | 0.755414472 |
| 2.0000 | 0.2000 | 33.242 | 0.772 | 0.732847822 |
| 2.2000 | 0.4000 | 33.2 | 0.73 | 0.71095531 |
| 2.4000 | 0.6000 | 33.177 | 0.707 | 0.689716798 |
| 2.6000 | 0.8000 | 33.148 | 0.678 | 0.669112748 |
| 2.8000 | 1.0000 | 33.125 | 0.655 | 0.649124208 |
| 3.0000 | 1.2000 | 33.103 | 0.633 | 0.629732788 |
| 3.2000 | 1.4000 | 33.083 | 0.613 | 0.610920653 |
| 3.4000 | 1.6000 | 33.064 | 0.594 | 0.592670497 |
| 3.6000 | 1.8000 | 33.045 | 0.575 | 0.574965531 |
| 3.8000 | 2.0000 | 33.028 | 0.558 | 0.557789469 |
| 4.0000 | 2.2000 | 33.009 | 0.539 | 0.541126511 |
| 4.2000 | 2.4000 | 32.999 | 0.529 | 0.524961329 |
| 4.4000 | 2.6000 | 32.983 | 0.513 | 0.509279052 |
| 4.6000 | 2.8000 | 32.967 | 0.497 | 0.494065256 |
| 4.8000 | 3.0000 | 32.954 | 0.484 | 0.479305944 |
| 5.0000 | 3.2000 | 32.938 | 0.468 | 0.464987541 |
| 5.2000 | 3.4000 | 32.922 | 0.452 | 0.451096874 |
| 5.4000 | 3.6000 | 32.912 | 0.442 | 0.437621165 |
| 5.6000 | 3.8000 | 32.899 | 0.429 | 0.424548019 |
| 5.8000 | 4.0000 | 32.883 | 0.413 | 0.41186541 |
| 6.0000 | 4.2000 | 32.873 | 0.403 | 0.399561671 |
| 6.2000 | 4.4000 | 32.857 | 0.387 | 0.387625484 |
| 6.4000 | 4.6000 | 32.847 | 0.377 | 0.37604587 |
| 6.6000 | 4.8000 | 32.835 | 0.365 | 0.364812175 |
| 6.8000 | 5.0000 | 32.822 | 0.352 | 0.353914067 |
| 7.0000 | 5.2000 | 32.812 | 0.342 | 0.34334152 |
| 7.2000 | 5.4000 | 32.802 | 0.332 | 0.333084809 |
| 7.4000 | 5.6000 | 32.789 | 0.319 | 0.323134499 |
| 7.6000 | 5.8000 | 32.78 | 0.31 | 0.313481437 |
| 7.8000 | 6.0000 | 32.77 | 0.3 | 0.304116742 |
| 8.0000 | 6.2000 | 32.76 | 0.29 | 0.295031801 |
| 8.2000 | 6.4000 | 32.751 | 0.281 | 0.286218256 |
| 8.4000 | 6.6000 | 32.744 | 0.274 | 0.277668 |
| 8.6000 | 6.8000 | 32.734 | 0.264 | 0.269373168 |
| 8.8000 | 7.0000 | 32.728 | 0.258 | 0.261326129 |
| 9.0000 | 7.2000 | 32.725 | 0.255 | 0.25351948 |
| 9.2000 | 7.4000 | 32.715 | 0.245 | 0.245946041 |
| 9.4000 | 7.6000 | 32.705 | 0.235 | 0.238598845 |
| 9.6000 | 7.8000 | 32.702 | 0.232 | 0.231471134 |
| 9.8000 | 8.0000 | 32.692 | 0.222 | 0.224556349 |
| 10.0000 | 8.2000 | 32.692 | 0.222 | 0.217848132 |
| 12.0000 | 10.2000 | 32.634 | 0.164 | 0.160856587 |
| 14.0000 | 12.2000 | 32.589 | 0.119 | 0.118774678 |
| 16.0000 | 14.2000 | 32.56 | 0.09 | 0.087701873 |
| 18.0000 | 16.2000 | 32.54 | 0.07 | 0.064758067 |
| 20.0000 | 18.2000 | 32.528 | 0.058 | 0.047816622 |
| 22.0000 | 20.2000 | 32.508 | 0.038 | 0.035307251 |
| 24.0000 | 22.2000 | 32.495 | 0.025 | 0.026070473 |
| 26.0000 | 24.2000 | 32.492 | 0.022 | 0.019250141 |
| 28.0000 | 26.2000 | 32.482 | 0.012 | 0.014214086 |
| | | | | |

## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

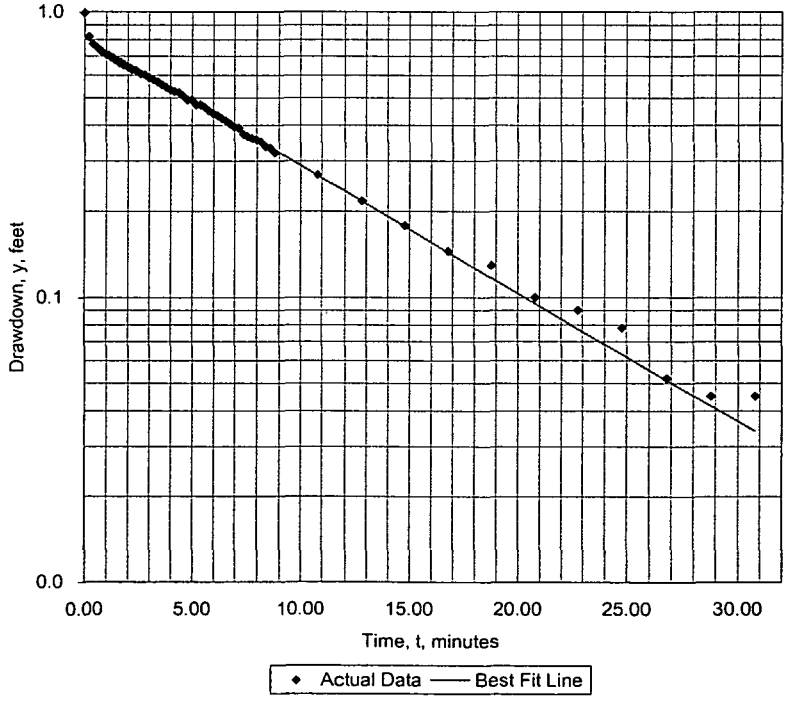
**MONITORING WELL MW-12**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

| Well Geometry | | | |
|---|---|---|---|
| Saturated Thickness (H), ft. | 50 | Radius of Well Casing (Rc), in | 1 |
| Screen Length, ft. | 10 | Radius of Boring (Rw), in | 4 |
| Depth to Water, ft. | 45.38 | Gravel Pack Porosity (n), % | 20% |
| Well Depth, ft. | 52.9 | Time Delay Factor, min: | 1.20 |

| Computed Data | | | |
|---|---|---|---|
| Effective Well Radius (Re), in. | 2.0 | Lw/Rw, ft/ft | 22.56 |
| Effective Screen Length (Le), ft. | 7.52 | Lw, ft | 7.52 |
| Full or Partial Penetration (F/P) | Partial | Le/Rw, ft/ft | 22.56 |

| Well Geometry Factors (See Attached Graph) | | |
|---|---|---|
| A | 2.2512 | Note: |
| B | 0.35164 | - Factors A and B are used for a partially penetrating well |
| C | | - Factor C is used for a fully penetrating well |

## BOUWER AND RICE SLUG TEST ANALYSIS




| Regression Analysis (Ln y vs. t) | |
|---|---|
| Slope of Line, (1/minutes): | 0.103103385 |
| Yo, ft | 0.812215838 |
| Ln(Re/rw) | 1.892708497 |
| Regression Coefficient, R^2: | 100% |

| Determination of Hydraulic Conductivity | |
|---|---|
| Conductivity, ft/minute | 3.60E-04 |
| ft/day | 5.19E-01 |
| cm/sec | 1.83E-04 |
| m/day | 1.58E-01 |

References:


1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.

2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-12**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

| Elapsed Time minutes | Corrected Time (t) minutes | Depth to Water feet | Drawdown feet | Predicted Drawdown feet |
|---|---|---|---|---|
| 1.2000 | 0.0000 | 46.372 | 0.992 | 0.812215838 |
| 1.4000 | 0.2000 | 46.198 | 0.818 | 0.795638899 |
| 1.6000 | 0.4000 | 46.152 | 0.772 | 0.779400287 |
| 1.8000 | 0.6000 | 46.13 | 0.75 | 0.763493098 |
| 2.0000 | 0.8000 | 46.104 | 0.724 | 0.747910566 |
| 2.2000 | 1.0000 | 46.088 | 0.708 | 0.732646067 |
| 2.4000 | 1.2000 | 46.075 | 0.695 | 0.717693109 |
| 2.6000 | 1.4000 | 46.059 | 0.679 | 0.703045334 |
| 2.8000 | 1.6000 | 46.043 | 0.663 | 0.688696513 |
| 3.0000 | 1.8000 | 46.03 | 0.65 | 0.674640545 |
| 3.2000 | 2.0000 | 46.02 | 0.64 | 0.660871452 |
| 3.4000 | 2.2000 | 46.007 | 0.627 | 0.64738338 |
| 3.6000 | 2.4000 | 46 | 0.62 | 0.634170592 |
| 3.8000 | 2.6000 | 45.984 | 0.604 | 0.621227472 |
| 4.0000 | 2.8000 | 45.981 | 0.601 | 0.608548515 |
| 4.2000 | 3.0000 | 45.968 | 0.588 | 0.596128329 |
| 4.4000 | 3.2000 | 45.958 | 0.578 | 0.583961633 |
| 4.6000 | 3.4000 | 45.946 | 0.566 | 0.572043254 |
| 4.8000 | 3.6000 | 45.933 | 0.553 | 0.560368123 |
| 5.0000 | 3.8000 | 45.923 | 0.543 | 0.548931276 |
| 5.2000 | 4.0000 | 45.913 | 0.533 | 0.537727849 |
| 5.4000 | 4.2000 | 45.904 | 0.524 | 0.52675308 |
| 5.6000 | 4.4000 | 45.9 | 0.52 | 0.5160023 |
| 5.8000 | 4.6000 | 45.887 | 0.507 | 0.505470938 |
| 6.0000 | 4.8000 | 45.871 | 0.491 | 0.495154516 |
| 6.2000 | 5.0000 | 45.871 | 0.491 | 0.485048648 |
| 6.4000 | 5.2000 | 45.852 | 0.472 | 0.475149036 |
| 6.6000 | 5.4000 | 45.852 | 0.472 | 0.46545147 |
| 6.8000 | 5.6000 | 45.842 | 0.462 | 0.455951826 |
| 7.0000 | 5.8000 | 45.829 | 0.449 | 0.446646066 |
| 7.2000 | 6.0000 | 45.819 | 0.439 | 0.437530232 |
| 7.4000 | 6.2000 | 45.813 | 0.433 | 0.428600448 |
| 7.6000 | 6.4000 | 45.803 | 0.423 | 0.419852917 |
| 7.8000 | 6.6000 | 45.794 | 0.414 | 0.411283919 |
| 8.0000 | 6.8000 | 45.784 | 0.404 | 0.402889809 |
| 8.2000 | 7.0000 | 45.774 | 0.394 | 0.39466702 |
| 8.4000 | 7.2000 | 45.771 | 0.391 | 0.386612053 |
| 8.6000 | 7.4000 | 45.752 | 0.372 | 0.378721485 |
| 8.8000 | 7.6000 | 45.745 | 0.365 | 0.37099196 |
| 9.0000 | 7.8000 | 45.739 | 0.359 | 0.36342019 |
| 9.2000 | 8.0000 | 45.735 | 0.355 | 0.356002957 |
| 9.4000 | 8.2000 | 45.729 | 0.349 | 0.348737106 |
| 9.6000 | 8.4000 | 45.716 | 0.336 | 0.341619547 |
| 9.8000 | 8.6000 | 45.713 | 0.333 | 0.334647255 |
| 10.0000 | 8.8000 | 45.7 | 0.32 | 0.327817263 |
| 12.0000 | 10.8000 | 45.648 | 0.268 | 0.266733374 |
| 14.0000 | 12.8000 | 45.597 | 0.217 | 0.217031562 |
| 16.0000 | 14.8000 | 45.558 | 0.178 | 0.176590946 |
| 18.0000 | 16.8000 | 45.525 | 0.145 | 0.14368584 |
| 20.0000 | 18.8000 | 45.509 | 0.129 | 0.116912113 |
| 22.0000 | 20.8000 | 45.48 | 0.1 | 0.095127273 |
| 24.0000 | 22.8000 | 45.47 | 0.09 | 0.077401715 |
| 26.0000 | 24.8000 | 45.458 | 0.078 | 0.062979053 |
| 28.0000 | 26.8000 | 45.432 | 0.052 | 0.051243839 |
| 30.0000 | 28.8000 | 45.425 | 0.045 | 0.041695309 |
| 32.0000 | 30.8000 | 45.425 | 0.045 | 0.033926006 |
| | | | | |
| | | | | |

## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-13**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

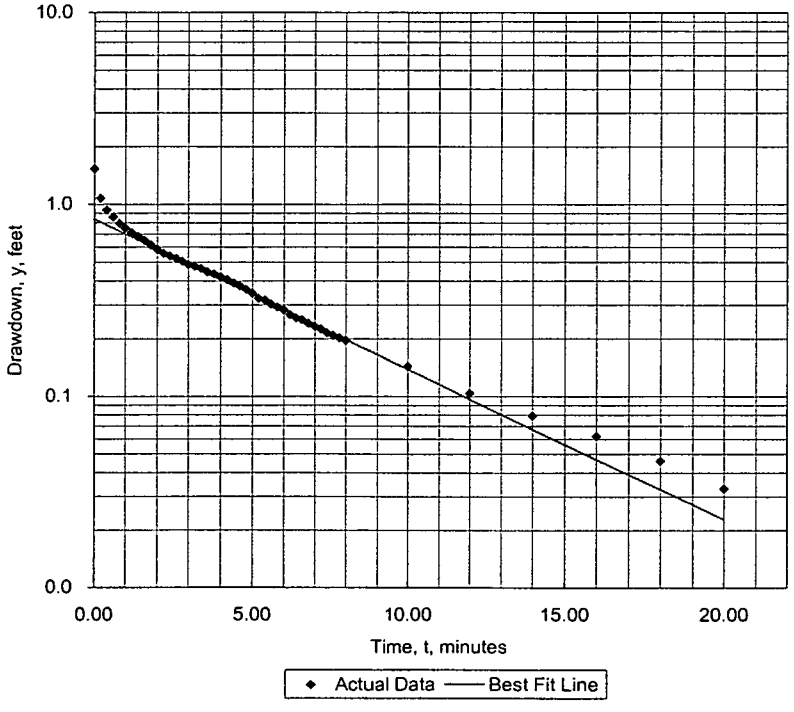
| Well Geometry | | | |
|---|---|---|---|
| Saturated Thickness (H), ft. | 50 | Radius of Well Casing (Rc), in | 1 |
| Screen Length, ft. | 15 | Radius of Boring (Rw), in | 4 |
| Depth to Water, ft. | 28.25 | Gravel Pack Porosity (n), % | 20% |
| Well Depth, ft. | 36.9 | Time Delay Factor, min: | 2.00 |

| Computed Data | | | |
|---|---|---|---|
| Effective Well Radius (Re), in. | 2.0 | Lw/Rw, ft/ft | 25.95 |
| Effective Screen Length (Le), ft. | 8.65 | Lw, ft | 8.65 |
| Full or Partial Penetration (F/P) | Partial | Le/Rw, ft/ft | 25.95 |

Well Geometry Factors (See Attached Graph)

| | | |
|---|---|---|
| A | 2.3285 | Note: |
| B | 0.372725 | - Factors A and B are used for a partially penetrating well |
| C | | - Factor C is used for a fully penetrating well |

## BOUWER AND RICE SLUG TEST ANALYSIS




| Regression Analysis (Ln y vs. t) | | Determination of Hydraulic Conductivity | |
|---|---|---|---|
| Slope of Line, (1/minutes): | 0.180192495 | Conductivity, ft/minute | 5.82E-04 |
| Yo, ft | 0.838442754 | ft/day | 8.39E-01 |
| Ln(Re/rw) | 2.012919989 | cm/sec | 2.96E-04 |
| Regression Coefficient, R^2: | 100% | m/day | 2.56E-01 |

NOTE: The first 3 minutes of data points are thought to be indicative of filter pack drainage & the last 4 data points indicative of inherent deviation from linear recovery. These points were not used in the linear regression.

References:

1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.

2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-13**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

| Elapsed Time minutes | Corrected Time (t) minutes | Depth to Water feet | Drawdown feet | Predicted Drawdown feet |
|---|---|---|---|---|
| 2.0000 | 0.0000 | 29.78 | 1.53 | 0.838442754 |
| 2.2000 | 0.2000 | 29.327 | 1.077 | 0.808764527 |
| 2.4000 | 0.4000 | 29.185 | 0.935 | 0.780136816 |
| 2.6000 | 0.6000 | 29.108 | 0.858 | 0.752522435 |
| 2.8000 | 0.8000 | 29.046 | 0.796 | 0.725885516 |
| 3.0000 | 1.0000 | 29.001 | 0.751 | 0.70019146 |
| 3.2000 | 1.2000 | 28.962 | 0.712 | 0.675406892 |
| 3.4000 | 1.4000 | 28.93 | 0.68 | 0.65149962 |
| 3.6000 | 1.6000 | 28.897 | 0.647 | 0.62843859 |
| 3.8000 | 1.8000 | 28.862 | 0.612 | 0.606193848 |
| 4.0000 | 2.0000 | 28.83 | 0.58 | 0.584736499 |
| 4.2000 | 2.2000 | 28.804 | 0.554 | 0.564038673 |
| 4.4000 | 2.4000 | 28.788 | 0.538 | 0.544073484 |
| 4.6000 | 2.6000 | 28.771 | 0.521 | 0.524815 |
| 4.8000 | 2.8000 | 28.755 | 0.505 | 0.506238205 |
| 5.0000 | 3.0000 | 28.736 | 0.486 | 0.488318971 |
| 5.2000 | 3.2000 | 28.726 | 0.476 | 0.471034021 |
| 5.4000 | 3.4000 | 28.713 | 0.463 | 0.454360903 |
| 5.6000 | 3.6000 | 28.694 | 0.444 | 0.438277961 |
| 5.8000 | 3.8000 | 28.684 | 0.434 | 0.422764305 |
| 6.0000 | 4.0000 | 28.668 | 0.418 | 0.407799783 |
| 6.2000 | 4.2000 | 28.655 | 0.405 | 0.393364958 |
| 6.4000 | 4.4000 | 28.639 | 0.389 | 0.37944108 |
| 6.6000 | 4.6000 | 28.626 | 0.376 | 0.366010063 |
| 6.8000 | 4.8000 | 28.61 | 0.36 | 0.353054462 |
| 7.0000 | 5.0000 | 28.594 | 0.344 | 0.340557449 |
| 7.2000 | 5.2000 | 28.574 | 0.324 | 0.32850279 |
| 7.4000 | 5.4000 | 28.568 | 0.318 | 0.316874828 |
| 7.6000 | 5.6000 | 28.552 | 0.302 | 0.30565846 |
| 7.8000 | 5.8000 | 28.542 | 0.292 | 0.294839115 |
| 8.0000 | 6.0000 | 28.532 | 0.282 | 0.284402741 |
| 8.2000 | 6.2000 | 28.516 | 0.266 | 0.274335782 |
| 8.4000 | 6.4000 | 28.506 | 0.256 | 0.264625161 |
| 8.6000 | 6.6000 | 28.5 | 0.25 | 0.255258265 |
| 8.8000 | 6.8000 | 28.49 | 0.24 | 0.246222928 |
| 9.0000 | 7.0000 | 28.481 | 0.231 | 0.237507414 |
| 9.2000 | 7.2000 | 28.474 | 0.224 | 0.229100401 |
| 9.4000 | 7.4000 | 28.464 | 0.214 | 0.22099097 |
| 9.6000 | 7.6000 | 28.458 | 0.208 | 0.213168587 |
| 9.8000 | 7.8000 | 28.451 | 0.201 | 0.205623092 |
| 10.0000 | 8.0000 | 28.445 | 0.195 | 0.198344684 |
| 12.0000 | 10.0000 | 28.393 | 0.143 | 0.138327125 |
| 14.0000 | 12.0000 | 28.354 | 0.104 | 0.096470413 |
| 16.0000 | 14.0000 | 28.329 | 0.079 | 0.067279217 |
| 18.0000 | 16.0000 | 28.312 | 0.062 | 0.046921049 |
| 20.0000 | 18.0000 | 28.296 | 0.046 | 0.032723105 |
| 22.0000 | 20.0000 | 28.283 | 0.033 | 0.022821348 |
| | | | | |
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## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

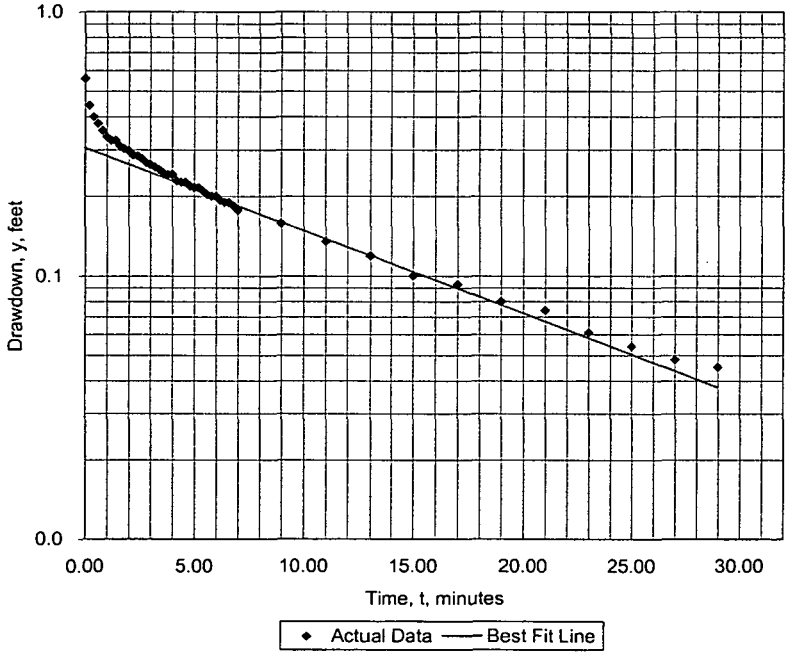
**MONITORING WELL MW-14**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

| Well Geometry | | | |
|---|---|---|---|
| Saturated Thickness (H), ft. | 50 | Radius of Well Casing (Rc), in | 1 |
| Screen Length, ft. | 15 | Radius of Boring (Rw), in | 4 |
| Depth to Water, ft. | 46.79 | Gravel Pack Porosity (n), % | 20% |
| Well Depth, ft. | 50 | Time Delay Factor, min: | 3.00 |

| Computed Data | | | |
|---|---|---|---|
| Effective Well Radius (Re), in. | 2.0 | Lw/Rw, ft/ft | 9.63 |
| Effective Screen Length (Le), ft. | 3.21 | Lw, ft | 3.21 |
| Full or Partial Penetration (F/P) | Partial | Le/Rw, ft/ft | 9.63 |

| Well Geometry Factors (See Attached Graph) | | |
|---|---|---|
| A | 1.8752 | Note: |
| B | 0.264075 | - Factors A and B are used for a partially penetrating well |
| C | | - Factor C is used for a fully penetrating well |

## BOUWER AND RICE SLUG TEST ANALYSIS




| Regression Analysis (Ln y vs. t) | |
|---|---|
| Slope of Line, (1/minutes): | 0.072113427 |
| Yo, ft | 0.306083808 |
| Ln(Re/rw) | 1.225514597 |
| Regression Coefficient, R^2: | 100% |

| Determination of Hydraulic Conductivity | |
|---|---|
| Conductivity, ft/minute | 3.82E-04 |
| ft/day | 5.51E-01 |
| cm/sec | 1.94E-04 |
| m/day | 1.68E-01 |

NOTE: The first 4 minutes of data points are thought to be indicative of filter pack drainage & the last 3 data points indicative of inherent deviation from linear recovery. These points were not used in the linear regression.

References:


1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.

2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-14**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

| Elapsed Time minutes | Corrected Time (t) minutes | Depth to Water feet | Drawdown feet | Predicted Drawdown feet |
|---|---|---|---|---|
| 3.0000 | 0.0000 | 47.349 | 0.559 | 0.306083808 |
| 3.2000 | 0.2000 | 47.232 | 0.442 | 0.30170094 |
| 3.4000 | 0.4000 | 47.19 | 0.4 | 0.297380831 |
| 3.6000 | 0.6000 | 47.168 | 0.378 | 0.293122582 |
| 3.8000 | 0.8000 | 47.145 | 0.355 | 0.288925308 |
| 4.0000 | 1.0000 | 47.126 | 0.336 | 0.284788136 |
| 4.2000 | 1.2000 | 47.116 | 0.326 | 0.280710204 |
| 4.4000 | 1.4000 | 47.116 | 0.326 | 0.276690665 |
| 4.6000 | 1.6000 | 47.1 | 0.31 | 0.272728683 |
| 4.8000 | 1.8000 | 47.093 | 0.303 | 0.268823433 |
| 5.0000 | 2.0000 | 47.087 | 0.297 | 0.264974102 |
| 5.2000 | 2.2000 | 47.077 | 0.287 | 0.261179891 |
| 5.4000 | 2.4000 | 47.074 | 0.284 | 0.25744001 |
| 5.6000 | 2.6000 | 47.067 | 0.277 | 0.253753681 |
| 5.8000 | 2.8000 | 47.058 | 0.268 | 0.250120138 |
| 6.0000 | 3.0000 | 47.054 | 0.264 | 0.246538623 |
| 6.2000 | 3.2000 | 47.048 | 0.258 | 0.243008393 |
| 6.4000 | 3.4000 | 47.042 | 0.252 | 0.239528713 |
| 6.6000 | 3.6000 | 47.035 | 0.245 | 0.236098859 |
| 6.8000 | 3.8000 | 47.032 | 0.242 | 0.232718118 |
| 7.0000 | 4.0000 | 47.032 | 0.242 | 0.229385786 |
| 7.2000 | 4.2000 | 47.019 | 0.229 | 0.22610117 |
| 7.4000 | 4.4000 | 47.016 | 0.226 | 0.222863588 |
| 7.6000 | 4.6000 | 47.016 | 0.226 | 0.219672365 |
| 7.8000 | 4.8000 | 47.009 | 0.219 | 0.216526837 |
| 8.0000 | 5.0000 | 47.006 | 0.216 | 0.213426351 |
| 8.2000 | 5.2000 | 47.006 | 0.216 | 0.210370262 |
| 8.4000 | 5.4000 | 47 | 0.21 | 0.207357933 |
| 8.6000 | 5.6000 | 46.993 | 0.203 | 0.204388738 |
| 8.8000 | 5.8000 | 46.99 | 0.2 | 0.201462059 |
| 9.0000 | 6.0000 | 46.99 | 0.2 | 0.198577289 |
| 9.2000 | 6.2000 | 46.983 | 0.193 | 0.195733825 |
| 9.4000 | 6.4000 | 46.98 | 0.19 | 0.192931078 |
| 9.6000 | 6.6000 | 46.98 | 0.19 | 0.190168464 |
| 9.8000 | 6.8000 | 46.974 | 0.184 | 0.187445408 |
| 10.0000 | 7.0000 | 46.967 | 0.177 | 0.184761344 |
| 12.0000 | 9.0000 | 46.948 | 0.158 | 0.159946296 |
| 14.0000 | 11.0000 | 46.925 | 0.135 | 0.138464123 |
| 16.0000 | 13.0000 | 46.909 | 0.119 | 0.119867193 |
| 18.0000 | 15.0000 | 46.89 | 0.1 | 0.103767991 |
| 20.0000 | 17.0000 | 46.883 | 0.093 | 0.089831051 |
| 22.0000 | 19.0000 | 46.87 | 0.08 | 0.077765963 |
| 24.0000 | 21.0000 | 46.864 | 0.074 | 0.067321321 |
| 26.0000 | 23.0000 | 46.851 | 0.061 | 0.058279485 |
| 28.0000 | 25.0000 | 46.844 | 0.054 | 0.050452045 |
| 30.0000 | 27.0000 | 46.838 | 0.048 | 0.043675899 |
| 32.0000 | 29.0000 | 46.835 | 0.045 | 0.037809847 |
| | | | | |
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## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-15**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

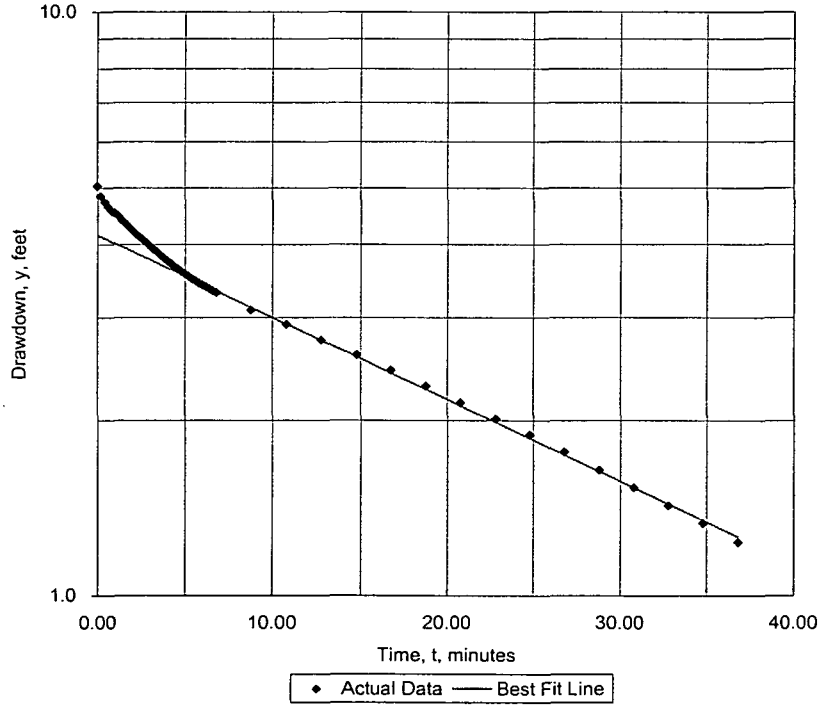
| Well Geometry | | | |
|---|---|---|---|
| Saturated Thickness (H), ft. | 50 | Radius of Well Casing (Rc), in | 1 |
| Screen Length, ft. | 15 | Radius of Boring (Rw), in | 4 |
| Depth to Water, ft. | 34.02 | Gravel Pack Porosity (n), % | 20% |
| Well Depth, ft. | 42.8 | Time Delay Factor, min: | 3.20 |

| Computed Data | | | |
|---|---|---|---|
| Effective Well Radius (Re), in. | 2.0 | Lw/Rw, ft/ft | 26.34 |
| Effective Screen Length (Le), ft. | 8.78 | Lw, ft | 8.78 |
| Full or Partial Penetration (F/P) | Partial | Le/Rw, ft/ft | 26.34 |

Well Geometry Factors (See Attached Graph)

| | | |
|---|---|---|
| A | 2.3402 | Note: |
| B | 0.37487 | - Factors A and B are used for a partially penetrating well |
| C | | - Factor C is used for a fully penetrating well |

## BOUWER AND RICE SLUG TEST ANALYSIS




| Regression Analysis (Ln y vs. t) | |
|---|---|
| Slope of Line, (1/minutes): | 0.032285928 |
| Yo, ft | 4.150225133 |
| Ln(Re/rw) | 2.025569372 |
| Regression Coefficient, R^2: | 100% |

| Determination of Hydraulic Conductivity | |
|---|---|
| Conductivity, ft/minute | 1.03E-04 |
| ft/day | 1.49E-01 |
| cm/sec | 5.26E-05 |
| m/day | 4.54E-02 |

References:


1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.

2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-15**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

| Elapsed Time minutes | Corrected Time (t) minutes | Depth to Water feet | Drawdown feet | Predicted Drawdown feet |
|---|---|---|---|---|
| 3.2000 | 0.0000 | 39.055 | 5.035 | 4.150225133 |
| 3.4000 | 0.2000 | 38.857 | 4.837 | 4.123512696 |
| 3.6000 | 0.4000 | 38.741 | 4.721 | 4.096972189 |
| 3.8000 | 0.6000 | 38.654 | 4.634 | 4.070602508 |
| 4.0000 | 0.8000 | 38.583 | 4.563 | 4.044402552 |
| 4.2000 | 1.0000 | 38.547 | 4.527 | 4.018371229 |
| 4.4000 | 1.2000 | 38.489 | 4.469 | 3.992507454 |
| 4.6000 | 1.4000 | 38.418 | 4.398 | 3.966810147 |
| 4.8000 | 1.6000 | 38.356 | 4.336 | 3.941278239 |
| 5.0000 | 1.8000 | 38.298 | 4.278 | 3.915910663 |
| 5.2000 | 2.0000 | 38.24 | 4.22 | 3.890706363 |
| 5.4000 | 2.2000 | 38.185 | 4.165 | 3.865664288 |
| 5.6000 | 2.4000 | 38.14 | 4.12 | 3.840783392 |
| 5.8000 | 2.6000 | 38.091 | 4.071 | 3.81606264 |
| 6.0000 | 2.8000 | 38.04 | 4.02 | 3.791501 |
| 6.2000 | 3.0000 | 37.988 | 3.968 | 3.767097448 |
| 6.4000 | 3.2000 | 37.943 | 3.923 | 3.742850967 |
| 6.6000 | 3.4000 | 37.901 | 3.881 | 3.718760546 |
| 6.8000 | 3.6000 | 37.856 | 3.836 | 3.694825179 |
| 7.0000 | 3.8000 | 37.807 | 3.787 | 3.67104387 |
| 7.2000 | 4.0000 | 37.768 | 3.748 | 3.647415626 |
| 7.4000 | 4.2000 | 37.726 | 3.706 | 3.623939463 |
| 7.6000 | 4.4000 | 37.687 | 3.667 | 3.600614401 |
| 7.8000 | 4.6000 | 37.652 | 3.632 | 3.577439469 |
| 8.0000 | 4.8000 | 37.616 | 3.596 | 3.554413699 |
| 8.2000 | 5.0000 | 37.581 | 3.561 | 3.531536132 |
| 8.4000 | 5.2000 | 37.548 | 3.528 | 3.508805813 |
| 8.6000 | 5.4000 | 37.516 | 3.496 | 3.486221796 |
| 8.8000 | 5.6000 | 37.487 | 3.467 | 3.463783138 |
| 9.0000 | 5.8000 | 37.458 | 3.438 | 3.441488904 |
| 9.2000 | 6.0000 | 37.429 | 3.409 | 3.419338164 |
| 9.4000 | 6.2000 | 37.406 | 3.386 | 3.397329994 |
| 9.6000 | 6.4000 | 37.377 | 3.357 | 3.375463478 |
| 9.8000 | 6.6000 | 37.351 | 3.331 | 3.353737703 |
| 10.0000 | 6.8000 | 37.329 | 3.309 | 3.332151763 |
| 12.0000 | 8.8000 | 37.109 | 3.089 | 3.123788144 |
| 14.0000 | 10.8000 | 36.938 | 2.918 | 2.928453763 |
| 16.0000 | 12.8000 | 36.766 | 2.746 | 2.745333886 |
| 18.0000 | 14.8000 | 36.611 | 2.591 | 2.573664723 |
| 20.0000 | 16.8000 | 36.459 | 2.439 | 2.412730248 |
| 22.0000 | 18.8000 | 36.311 | 2.291 | 2.261859207 |
| 24.0000 | 20.8000 | 36.165 | 2.145 | 2.12042232 |
| 26.0000 | 22.8000 | 36.033 | 2.013 | 1.98782966 |
| 28.0000 | 24.8000 | 35.91 | 1.89 | 1.863528184 |
| 30.0000 | 26.8000 | 35.787 | 1.767 | 1.746999435 |
| 32.0000 | 28.8000 | 35.664 | 1.644 | 1.637757375 |
| 34.0000 | 30.8000 | 35.554 | 1.534 | 1.535346357 |
| 36.0000 | 32.8000 | 35.448 | 1.428 | 1.439339228 |
| 38.0000 | 34.8000 | 35.354 | 1.334 | 1.349335545 |
| 40.0000 | 36.8000 | 35.257 | 1.237 | 1.264959906 |
| | | | | |
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## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-16**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

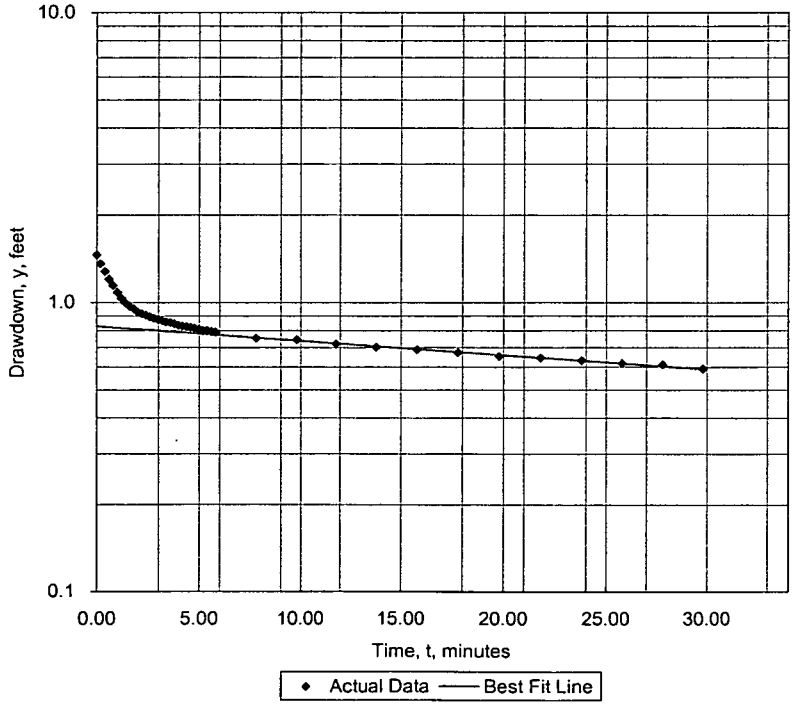
| Well Geometry | | | |
|---|---|---|---|
| Saturated Thickness (H), ft. | 50 | Radius of Well Casing (Rc), in | 1 |
| Screen Length, ft. | 15 | Radius of Boring (Rw), in | 4 |
| Depth to Water, ft. | 32.19 | Gravel Pack Porosity (n), % | 20% |
| Well Depth, ft. | 36 | Time Delay Factor, min: | 4.20 |

| Computed Data | | | |
|---|---|---|---|
| Effective Well Radius (Re), in. | 2.0 | Lw/Rw, ft/ft | 11.43 |
| Effective Screen Length (Le), ft. | 3.81 | Lw, ft | 3.81 |
| Full or Partial Penetration (F/P) | Partial | Le/Rw, ft/ft | 11.43 |

Well Geometry Factors (See Attached Graph)

| | | |
|---|---|---|
| A | 1.9243 | Note: |
| B | 0.27501 | - Factors A and B are used for a partially penetrating well |
| C | | - Factor C is used for a fully penetrating well |

## BOUWER AND RICE SLUG TEST ANALYSIS




| Regression Analysis (Ln y vs. t) | |
|---|---|
| Slope of Line, (1/minutes): | 0.011462351 |
| Yo, ft | 0.828072341 |
| Ln(Re/rw) | 1.35405747 |
| Regression Coefficient, R^2: | 99% |

| Determination of Hydraulic Conductivity | |
|---|---|
| Conductivity, ft/minute | 5.66E-05 |
| ft/day | 8.15E-02 |
| cm/sec | 2.88E-05 |
| m/day | 2.48E-02 |

References:


1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.

2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-16**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

| Elapsed Time minutes | Corrected Time (t) minutes | Depth to Water feet | Drawdown feet | Predicted Drawdown feet |
|---|---|---|---|---|
| 4.2000 | 0.0000 | 33.647 | 1.457 | 0.828072341 |
| 4.4000 | 0.2000 | 33.55 | 1.36 | 0.826176184 |
| 4.6000 | 0.4000 | 33.469 | 1.279 | 0.824284369 |
| 4.8000 | 0.6000 | 33.392 | 1.202 | 0.822396886 |
| 5.0000 | 0.8000 | 33.334 | 1.144 | 0.820513725 |
| 5.2000 | 1.0000 | 33.275 | 1.085 | 0.818634876 |
| 5.4000 | 1.2000 | 33.224 | 1.034 | 0.816760329 |
| 5.6000 | 1.4000 | 33.185 | 0.995 | 0.814890075 |
| 5.8000 | 1.6000 | 33.159 | 0.969 | 0.813024103 |
| 6.0000 | 1.8000 | 33.14 | 0.95 | 0.811162404 |
| 6.2000 | 2.0000 | 33.117 | 0.927 | 0.809304968 |
| 6.4000 | 2.2000 | 33.104 | 0.914 | 0.807451786 |
| 6.6000 | 2.4000 | 33.094 | 0.904 | 0.805602847 |
| 6.8000 | 2.6000 | 33.082 | 0.892 | 0.803758141 |
| 7.0000 | 2.8000 | 33.072 | 0.882 | 0.80191766 |
| 7.2000 | 3.0000 | 33.062 | 0.872 | 0.800081393 |
| 7.4000 | 3.2000 | 33.056 | 0.866 | 0.798249331 |
| 7.6000 | 3.4000 | 33.046 | 0.856 | 0.796421464 |
| 7.8000 | 3.6000 | 33.043 | 0.853 | 0.794597783 |
| 8.0000 | 3.8000 | 33.033 | 0.843 | 0.792778278 |
| 8.2000 | 4.0000 | 33.023 | 0.833 | 0.790962939 |
| 8.4000 | 4.2000 | 33.02 | 0.83 | 0.789151756 |
| 8.6000 | 4.4000 | 33.014 | 0.824 | 0.787344722 |
| 8.8000 | 4.6000 | 33.01 | 0.82 | 0.785541825 |
| 9.0000 | 4.8000 | 33.004 | 0.814 | 0.783743056 |
| 9.2000 | 5.0000 | 32.998 | 0.808 | 0.781948406 |
| 9.4000 | 5.2000 | 32.991 | 0.801 | 0.780157866 |
| 9.6000 | 5.4000 | 32.991 | 0.801 | 0.778371425 |
| 9.8000 | 5.6000 | 32.985 | 0.795 | 0.776589076 |
| 10.0000 | 5.8000 | 32.981 | 0.791 | 0.774810808 |
| 12.0000 | 7.8000 | 32.943 | 0.753 | 0.757250551 |
| 14.0000 | 9.8000 | 32.933 | 0.743 | 0.740088279 |
| 16.0000 | 11.8000 | 32.91 | 0.72 | 0.723314971 |
| 18.0000 | 13.8000 | 32.891 | 0.701 | 0.706921812 |
| 20.0000 | 15.8000 | 32.878 | 0.688 | 0.690900187 |
| 22.0000 | 17.8000 | 32.862 | 0.672 | 0.675241675 |
| 24.0000 | 19.8000 | 32.842 | 0.652 | 0.659938046 |
| 26.0000 | 21.8000 | 32.833 | 0.643 | 0.644981257 |
| 28.0000 | 23.8000 | 32.82 | 0.63 | 0.630363448 |
| 30.0000 | 25.8000 | 32.807 | 0.617 | 0.616076936 |
| 32.0000 | 27.8000 | 32.8 | 0.61 | 0.602114212 |
| 34.0000 | 29.8000 | 32.781 | 0.591 | 0.588467939 |
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## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

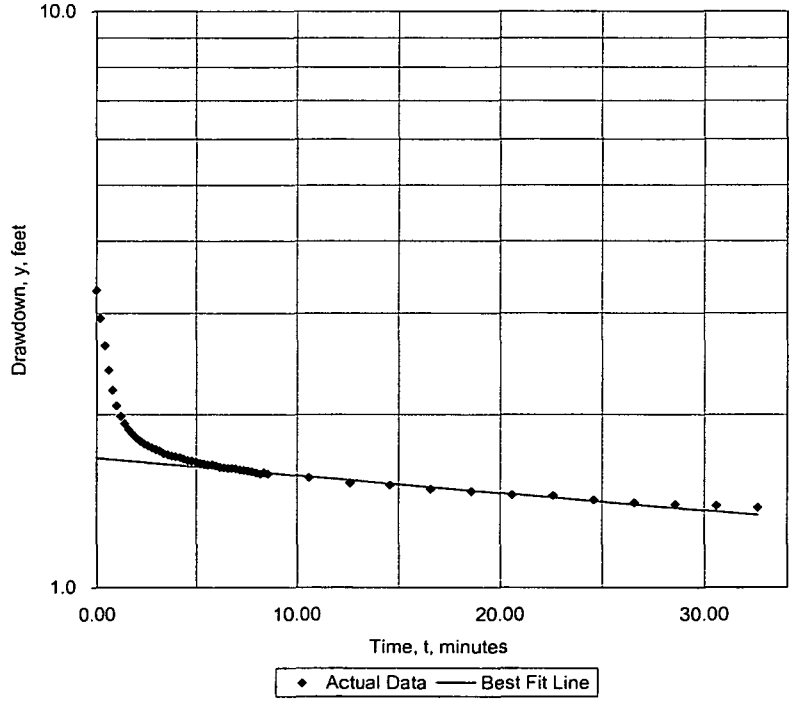
**MONITORING WELL MW-17**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

| Well Geometry | | | |
|---|---|---|---|
| Saturated Thickness (H), ft. | 50 | Radius of Well Casing (Rc), in | 1 |
| Screen Length, ft. | 15 | Radius of Boring (Rw), in | 4 |
| Depth to Water, ft. | 21.4 | Gravel Pack Porosity (n), % | 20% |
| Well Depth, ft. | 33 | Time Delay Factor, min: | 1.40 |

| Computed Data | | | |
|---|---|---|---|
| Effective Well Radius (Re), in. | 2.0 | Lw/Rw, ft/ft | 34.8 |
| Effective Screen Length (Le), ft. | 11.6 | Lw, ft | 11.6 |
| Full or Partial Penetration (F/P) | Partial | Le/Rw, ft/ft | 34.8 |

| Well Geometry Factors (See Attached Graph) | | |
|---|---|---|
| A | 2.594 | Note: |
| B | 0.4166 | - Factors A and B are used for a partially penetrating well |
| C | | - Factor C is used for a fully penetrating well |

## BOUWER AND RICE SLUG TEST ANALYSIS




| Regression Analysis (Ln y vs. t) | | Determination of Hydraulic Conductivity | |
|---|---|---|---|
| Slope of Line, (1/minutes): | 0.006980208 | Conductivity, ft/minute | 1.89E-05 |
| Yo, ft | 1.680291529 | ft/day | 2.73E-02 |
| Ln(Re/rw) | 2.266255964 | cm/sec | 9.63E-06 |
| Regression Coefficient, R^2: | 99% | m/day | 8.32E-03 |

NOTE: The first eight data points are thought to be indicative of filter pack drainage and are, therefore, not used in the linear regression.

References:


1) Bouwer, Herman. The Bouwer and Rice Slug Test - An Update. Groundwater. June 1989.

2) Bouwer, Herman and Rice, R.C. A Slug test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research. June 1976

## BOUWER AND RICE SLUG-OUT TEST ANALYSIS

**MONITORING WELL MW-17**
**Plymouth County Landfill**
**Plymouth County, Iowa**
**Project No. 40905033**

| Elapsed Time minutes | Corrected Time (t) minutes | Depth to Water feet | Drawdown feet | Predicted Drawdown feet |
|---|---|---|---|---|
| 1.4000 | 0.0000 | 24.689 | 3.289 | 1.680291529 |
| 1.6000 | 0.2000 | 24.34 | 2.94 | 1.677947409 |
| 1.8000 | 0.4000 | 24.033 | 2.633 | 1.675606559 |
| 2.0000 | 0.6000 | 23.787 | 2.387 | 1.673268974 |
| 2.2000 | 0.8000 | 23.603 | 2.203 | 1.670934651 |
| 2.4000 | 1.0000 | 23.471 | 2.071 | 1.668603584 |
| 2.6000 | 1.2000 | 23.387 | 1.987 | 1.666275769 |
| 2.8000 | 1.4000 | 23.328 | 1.928 | 1.663951202 |
| 3.0000 | 1.6000 | 23.283 | 1.883 | 1.661629877 |
| 3.2000 | 1.8000 | 23.251 | 1.851 | 1.659311791 |
| 3.4000 | 2.0000 | 23.222 | 1.822 | 1.656996939 |
| 3.6000 | 2.2000 | 23.199 | 1.799 | 1.654685316 |
| 3.8000 | 2.4000 | 23.177 | 1.777 | 1.652376918 |
| 4.0000 | 2.6000 | 23.164 | 1.764 | 1.65007174 |
| 4.2000 | 2.8000 | 23.151 | 1.751 | 1.647769779 |
| 4.4000 | 3.0000 | 23.138 | 1.738 | 1.645471028 |
| 4.6000 | 3.2000 | 23.128 | 1.728 | 1.643175485 |
| 4.8000 | 3.4000 | 23.112 | 1.712 | 1.640883144 |
| 5.0000 | 3.6000 | 23.102 | 1.702 | 1.638594001 |
| 5.2000 | 3.8000 | 23.093 | 1.693 | 1.636308051 |
| 5.4000 | 4.0000 | 23.089 | 1.689 | 1.634025291 |
| 5.6000 | 4.2000 | 23.083 | 1.683 | 1.631745715 |
| 5.8000 | 4.4000 | 23.073 | 1.673 | 1.629469319 |
| 6.0000 | 4.6000 | 23.063 | 1.663 | 1.6271961 |
| 6.2000 | 4.8000 | 23.06 | 1.66 | 1.624926051 |
| 6.4000 | 5.0000 | 23.054 | 1.654 | 1.622659169 |
| 6.6000 | 5.2000 | 23.044 | 1.644 | 1.62039545 |
| 6.8000 | 5.4000 | 23.041 | 1.641 | 1.618134888 |
| 7.0000 | 5.6000 | 23.034 | 1.634 | 1.615877481 |
| 7.2000 | 5.8000 | 23.034 | 1.634 | 1.613623222 |
| 7.4000 | 6.0000 | 23.028 | 1.628 | 1.611372109 |
| 7.6000 | 6.2000 | 23.018 | 1.618 | 1.609124136 |
| 7.8000 | 6.4000 | 23.015 | 1.615 | 1.606879299 |
| 8.0000 | 6.6000 | 23.012 | 1.612 | 1.604637593 |
| 8.2000 | 6.8000 | 23.012 | 1.612 | 1.602399015 |
| 8.4000 | 7.0000 | 23.009 | 1.609 | 1.60016356 |
| 8.6000 | 7.2000 | 23.002 | 1.602 | 1.597931224 |
| 8.8000 | 7.4000 | 22.999 | 1.599 | 1.595702002 |
| 9.0000 | 7.6000 | 22.996 | 1.596 | 1.593475889 |
| 9.2000 | 7.8000 | 22.992 | 1.592 | 1.591252883 |
| 9.4000 | 8.0000 | 22.983 | 1.583 | 1.589032977 |
| 9.6000 | 8.2000 | 22.976 | 1.576 | 1.586816169 |
| 9.8000 | 8.4000 | 22.986 | 1.586 | 1.584602453 |
| 10.0000 | 8.6000 | 22.976 | 1.576 | 1.582391825 |
| 12.0000 | 10.6000 | 22.954 | 1.554 | 1.560454459 |
| 14.0000 | 12.6000 | 22.921 | 1.521 | 1.538821221 |
| 16.0000 | 14.6000 | 22.908 | 1.508 | 1.517487893 |
| 18.0000 | 16.6000 | 22.883 | 1.483 | 1.496450318 |
| 20.0000 | 18.6000 | 22.87 | 1.47 | 1.475704395 |
| 22.0000 | 20.6000 | 22.85 | 1.45 | 1.455246082 |
| 24.0000 | 22.6000 | 22.847 | 1.447 | 1.435071392 |
| 26.0000 | 24.6000 | 22.821 | 1.421 | 1.415176391 |
| 28.0000 | 26.6000 | 22.805 | 1.405 | 1.395557204 |
| 30.0000 | 28.6000 | 22.795 | 1.395 | 1.376210005 |
| 32.0000 | 30.6000 | 22.789 | 1.389 | 1.357131025 |
| 34.0000 | 32.6000 | 22.779 | 1.379 | 1.338316545 |
| | | | 0 | |